Date Received for Clearance Process (MM/DD/YYYY)
03/26/07

INFORMATION CLEARANCE FORM

A. Information Category

- [ ] Abstract
- [ ] Summary
- [ ] Visual Aid
- [ ] Full Paper
- [ ] Journal Article
- [ ] Internet
- [ ] Software
- [x] Report
- [ ] Other _____

B. Document Number D&D-30262 Rev. 0

C. Title
Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances

D. Internet Address

E. Required Information (MANDATORY)

1. Is document potentially Classified? (•) No ( ) Yes
L. R. Fitch
Manager Required (Print and Sign)

If Yes _____
ADC Required (Print and Sign) ( ) No ( ) Yes Classified

2. Official Use Only (•) No ( ) Yes Exemption No. ____
3. Export Controlled Information (•) No ( ) Yes OUO Exemption No. 3
4. UCNI (•) No ( ) Yes
5. Applied Technology (•) No ( ) Yes
6. Other (Specify) _____

7. Does Information Contain the Following:

a. New or Novel FH (Patentable) Subject Matter? (•) No ( ) Yes
If "Yes", OUO Exemption No. 3
If "Yes", Disclosure No.: _____

b. Commercial Proprietary Information Received in Confidence, Such as Proprietary and/or Inventions?
(•) No ( ) Yes If "Yes", OUO Exemption No. 4

c. Corporate Privileged Information? (•) No ( ) Yes
If "Yes", OUO Exemption No. 4

d. Government Privileged Information? (•) No ( ) Yes
If "Yes", Exemption No. 5

e. Copyrights? (•) No ( ) Yes If "Yes", Attach Permission.

f. Trademarks? (•) No ( ) Yes If "Yes", Identify in Document.

8. Is Information requiring submission to OSTI? (•) No ( ) Yes

9. Release Level? (•) Public ( ) Limited

F. Complete for a Journal Article

1. Title of Journal

G. Complete for a Presentation

1. Title for Conference or Meeting _____
2. Group Sponsoring _____
3. Date of Conference _____ 4. City/State _____
5. Will Information be Published in Proceedings? ( ) No ( ) Yes 6. Will Material be Handed Out? ( ) No ( ) Yes

H. Information Owner/Author/Requestor
M. J. Hickey
(Print and Sign)

Responsible Manager
L. R. Fitch
(Print and Sign)

Approval by Direct Report to FH President (Speech/Articles Only) _____
(Print and Sign)

I. Reviewers

	Yes	Print	Signature	Public Y/N (If N, complete J)
General Counsel	☐			Y / N
Office of External Affairs	☐			Y / N
DOE-RL	☒	K. D. Leary		(Y) / N
Other	☒	M. J. Hickey		(Y) / N
Other	☒	J. D. Aardal		(Y) / N

J. Comments

If Additional Comments, Please Attach Separate Sheet

Information Clearance Approval

APPROVED FOR PUBLIC RELEASE
OFFICIAL DOCUMENT
Date: 4/2/2007

A-6001-401 (REV 1)

ADMINISTRATIVE DOCUMENT PROCESSING AND APPROVAL

DOCUMENT TITLE:
Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances

OWNING ORGANIZATION/FACILITY:
Soil & Groundwater Remediation

Document Number: D&D-30262

Revision/Change Number: 0

DOCUMENT TYPE *(Check Applicable)*

☐ Plan ☒ Report ☐ Study ☐ Description Document ☐ Other

DOCUMENT ACTION ◉ New ○ Revision ○ Cancellation

RESPONSIBLE CONTACTS

Name	Phone Number
Author: M. J. Hickey	373.3092
Manager: L. R. Fitch	376.7536

DOCUMENT CONTROL

Does document contain scientific or technical information intended for public use? ◉ Yes ○ No

Does document contain controlled-use information? ○ Yes ◉ No

("Yes" requires information clearance review in accordance with HNF-PRO-184)

DOCUMENT REVISION SUMMARY

NOTE: Provide a brief description or summary of the changes for the document listed.

REVIEWERS **Others**

Name *(print)*	Organization
R. G. Bauer	Soil&Groundwater Remediation
J. E. Bramson	Soil&Groundwater Remediation
H. E. Rew	QA
F. A. Ruck	Environmental Compliance

APPROVAL SIGNATURES

Author: Michael Hickey	3/26/07 Date	RELEASE / ISSUE
Name: (Print) M. J. Hickey		
Responsible Manager: L R Fitch	Date 3/26/07	
Name: (Print) L. R. Fitch		
Other:		
Name: (Print) F. A. Ruck F G Ruck	Date 3/27/07	
Other:		
Name: (Print) H. E. REW A Mroveltyg e-mail	Date 3/26/07	
Other:		
Name: (Print)	Date	

APR 02 2007
DATE:
STA: 15
HANFORD RELEASE
ID: 20

D&D-30262
Revision 0

Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

FLUOR®
P.O. Box 1000
Richland, Washington

D&D-30262
Revision 0

Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances

Date Published
March 2007

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

FLUOR®
P.O. Box 1000
Richland, Washington

J. D. Aardal 4/2/2007
Release Approval Date

Approved for Public Release;
Further Dissemination Unlimited

APPROVAL PAGE

Title: **Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances**

Approvals: M. J. Hickey Fluor Hanford, Inc.

Signature 3/27/07 Date

J. W. Badden, CH2M HILL Hanford Group, Inc.

Signature 3/27/07 Date

CONCURRENCE PAGE

Title: **Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances**

Concurrences:

K. D. Leary

U. S. Department of Energy, Richland Operations Office

Signature 3/27/07 Date

B. L. Charboneau

U. S. Department of Energy, Richland Operations Office

Signature 3-27-2007 Date

M. S. McCormick

U. S. Department of Energy, Richland Operations Office

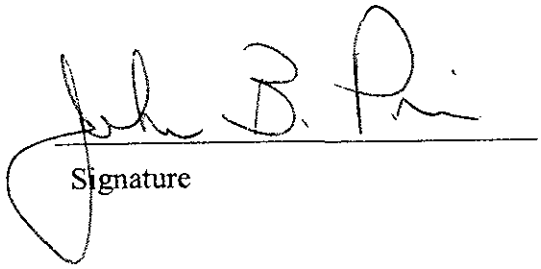
Signature 3/27/07 Date

CONCURRENCE PAGE

Title: **Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances**

Concurrences: J. B. Price

State of Washington, Department of Ecology



Signature

3/28/2007

Date

This page intentionally left blank.

EXECUTIVE SUMMARY

This data quality objectives (DQO) summary report supports site-characterization decisions for remedial investigation (RI) of the 200-IS-1 Tanks/Lines/Pits/ Waste Group Operable Unit (OU) process waste pipelines. The 200-IS-1 OU consists of *Resource Conservation and Recovery Act of 1976* (RCRA) past-practice waste sites and treatment, storage, and disposal units. The OU designation and waste-site assignments are defined in DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*, and DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan—Environmental Restoration Program.* This summary report has been developed to support the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) work plan and sampling and analysis plan remedial investigation/feasibility study activities and remedial-action decision-making processes for the 200-IS-1 OU.

The 200-IS-1 OU includes an extensive network of pipelines, diversion boxes, catch tanks, valve pits, related infrastructure, and associated unplanned releases. For the DQO, this network was defined as the process-waste pipeline systems. The systems were used to transport process waste from the separations facilities to the single- and double-shell tanks and to control or divert flow to disposal waste sites that received liquid-waste streams. The process-waste pipeline systems primarily are located within the industrial 200 Areas of the Hanford Site Central Plateau.

The scope of this DQO summary report is limited to the inactive process-waste pipeline systems. The DQO process does not include evaluation of waterlines, utility lines, inert gas lines, sewer, steam condensate, and above-ground pipelines or active pipelines.

The primary objectives of the DQO process for the process-waste pipeline systems include the following.

- Determine the environmental measurements necessary to support the remedial investigation/feasibility study process and remedial decision-making.
- Identify data needed for development of the remedial investigation/feasibility study work plan and sampling and analysis plan.

- Identify evaluation and preliminary remediation strategies that are inclusive of both RCRA and CERCLA requirements for the 200-IS-1 OU pipelines.

- Develop preliminary conceptual-contaminant-distribution model(s) that reflect the physical characteristics of the process-waste pipeline systems and surrounding soil and the anticipated distribution of contaminants. Data collection will support refinement of the model(s).

Data collected during the RI will be used to determine if the process-waste pipeline systems are contaminated above levels that will require remedial action, to support evaluation of remedial alternatives and/or closure strategies, and to verify or refine the preliminary conceptual-contaminant-distribution models.

During the DQO process, a binning strategy was developed that groups process-waste pipelines with similar process histories and contaminants for field investigations and sampling during RI activities. A two-phase sampling approach, with different data-collection objectives and requirements for each phase, was identified for the process-waste pipeline systems. Phase 1 will consist of acquisition of a data set that is smaller than that required for Phase 2. The purpose of the Phase 1 investigation will be to gather limited data in support of existing information that indicates that contamination likely is present at concentrations above preliminary cleanup levels. The data collected will be used to determine whether contaminant levels are consistently above action levels and to support remedial decision making (other than the no-action alternative).

Phase 2 sampling will be used for evaluation of those pipelines and associated structures where there is considerable uncertainty concerning whether contamination exceeding action levels is present. Proceeding directly to Phase 2 sampling would be appropriate for those pipelines where existing information indicates that contamination will not be present and/or where considerable variability is expected in potential results. Phase 2 sampling will be required if all remedial alternatives need to be assessed, including the no-action alternative. Phase 2 sampling requires a larger data set for decision-making. Phase 2 sampling is dependent on the results of Phase 1 sampling. Therefore, this DQO does not address specific sampling design objectives for Phase 2. This information will be developed in a separate DQO or sampling and analysis plan, as needed.

The interiors of pipelines, associated appurtenances, and surrounding soils were identified as requiring data collection for remedial decision-making. Measured concentrations will be compared with the preliminary cleanup levels. The nature (for example, contaminant type and concentration) and extent of the contamination are the major RI data needs. Specific sampling needs for appurtenances were determined to be part of the collection activities in Phase 2; i.e., characterization needs are dependent on the results of Phase 1 sampling. Therefore, specific sampling-design objectives for appurtenances will be developed in a future DQO or sampling and analysis plan.

Contaminants of potential concern were identified through process-history information and previous data-collection activities. Liquid-process-waste streams carried through the pipeline systems required disposition decisions that involved either transfer to tanks within Waste Management Areas or disposal from facilities operations to cribs, trenches, or other liquid-waste disposal sites. These waste-transfer and disposal decisions were based on waste composition. Because of known differences in process waste-stream characteristics, two separate lists were developed for contaminants of potential concern and analytical reporting requirements. One list is for waste streams transferred from facilities directly to liquid-disposal waste sites, and the second is for those process wastes sent to/transferred between or transferred out of tank farms.

Chemical analytical performance criteria were defined based on compliance criteria in *Washington Administrative Code* WAC 173-340, "Model Toxics Control Act -- Cleanup," and other potentially applicable or relevant and appropriate requirements. In the absence of applicable or relevant and appropriate requirements, other preliminary cleanup levels were identified to determine analytical performance criteria. These levels provide the basis for identifying the laboratory detection limits required to support remedial action decisions.

Radiological analytical-performance criteria were defined based on compliance criteria in CERCLA. CERCLA criteria expressed in the applicable or relevant and appropriate requirements section of this DQO, and other preliminary cleanup levels identified in this DQO, determine the analytical performance criteria. These levels provide the basis for identifying the laboratory detection limits required to support remedial-action decisions

This page intentionally left blank.

CONTENTS

APPENDIX

FIGURES

TABLES

TERMS

AA	alternative action
AEA	alpha energy analysis
AMSCO	Allen Maintenance Supply Company, Inc.
ANN	aluminum nitrate nonahydrate
ARAR	applicable or relevant and appropriate requirement
bgs	below the ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COPC	contaminant of potential concern
CUL	cleanup level
DL	detection limit
DOE	U.S. Department of Energy
DQO	data quality objective
DR	decision rule
DS	decision statement
DST	double-shell tank
Ecology	Washington State Department of Ecology
EMI	electromagnetic imaging
EPA	U.S. Environmental Protection Agency
FS	feasibility study
GPR	ground-penetrating radar
GS	gamma spectroscopy
HEIS	*Hanford Environmental Information System* database
IC	ion chromatography
IDW	investigation-derived waste
Implementation Plan	*200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (DOE/RL-98-28)
ITS	in-tank solidification
IX	ion exchange
K_d	distribution coefficient
LERF	Liquid Effluent Disposal Facility
LLWMA	Low-Level Waste Management Area
LSC	liquid scintillation counter
MCL	maximum contamination level
MCLG	maximum contamination level goal
MIBK	methyl isobutyl ketone (hexone)
N/A	not applicable
NaI	sodium iodide
NPH	normal paraffin hydrocarbon
NRC	U.S. Nuclear Regulatory Commission
OU	operable unit
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant

PIF	Plutonium Isolation Facility
PRF	Plutonium Reclamation Facility
PSQ	principal study question
PUREX	plutonium-uranium extraction
RCRA	*Resource Conservation and Recovery Act of 1976-*
RECUPLEX	Recovery of Uranium and Plutonium by Extraction
REDOX	reduction-oxidation
RESRAD	RESidual RADioactivity dose model
RG	rubber glove
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RMA	remote mechanical "A"
RMB	remote mechanical "B"
RMC	remote mechanical "C"
ROD	record of decision
SAP	sampling and analysis plan
SST	single-shell tank
STOMP	subsurface transport over multiple phases
TBC	to be considered
TBP	tributyl phosphate
TCLP	toxicity characteristic leaching procedure
TRU (waste)	radioactive waste containing more than 100 nCi/g (3700 Bq/g) of alpha-emitting transuranic isotopes with half-lives greater than 20 years, other than the exceptions noted in DOE G 435.1-1, Chapter 3, "Transuranic Waste Requirements"
TRU	transuranic
TSD	treatment, storage, and disposal
UNH	uranyl nitrate hexahydrate
UO_3	uranium trioxide
UPR	unplanned release
URP	uranium recovery process
VOC	volatile organic compound
WAC	*Washington Administrative Code*
WESF	Waste Encapsulation and Storage Facility
WIDS	*Waste Information Data System* database
WMA	Waste Management Area

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	Millimeters	millimeters	0.039	inches
inches	2.54	Centimeters	centimeters	0.394	inches
feet	0.305	Meters	meters	3.281	feet
yards	0.914	Meters	meters	1.094	yards
miles	1.609	Kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	Hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	Grams	grams	0.035	ounces
pounds	0.454	Kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	Milliliters	milliliters	0.033	fluid ounces
tablespoons	15	Milliliters	liters	2.1	pints
fluid ounces	30	Milliliters	liters	1.057	quarts
cups	0.24	Liters	liters	0.264	gallons
pints	0.47	Liters	cubic meters	35.315	cubic feet
quarts	0.95	Liters	cubic meters	1.308	cubic yards
gallons	3.8	Liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	Millibecquerel	millibecquerel	0.027	picocuries

1.0 STEP 1 -- STATE THE PROBLEM

Given that the process pipeline systems in the Central Plateau received waste discharges, the problem is to determine from process history and/or data collection and analysis whether pipelines or surrounding soils contain constituents that are above regulatory and/or risk thresholds.

1.1 INTRODUCTION

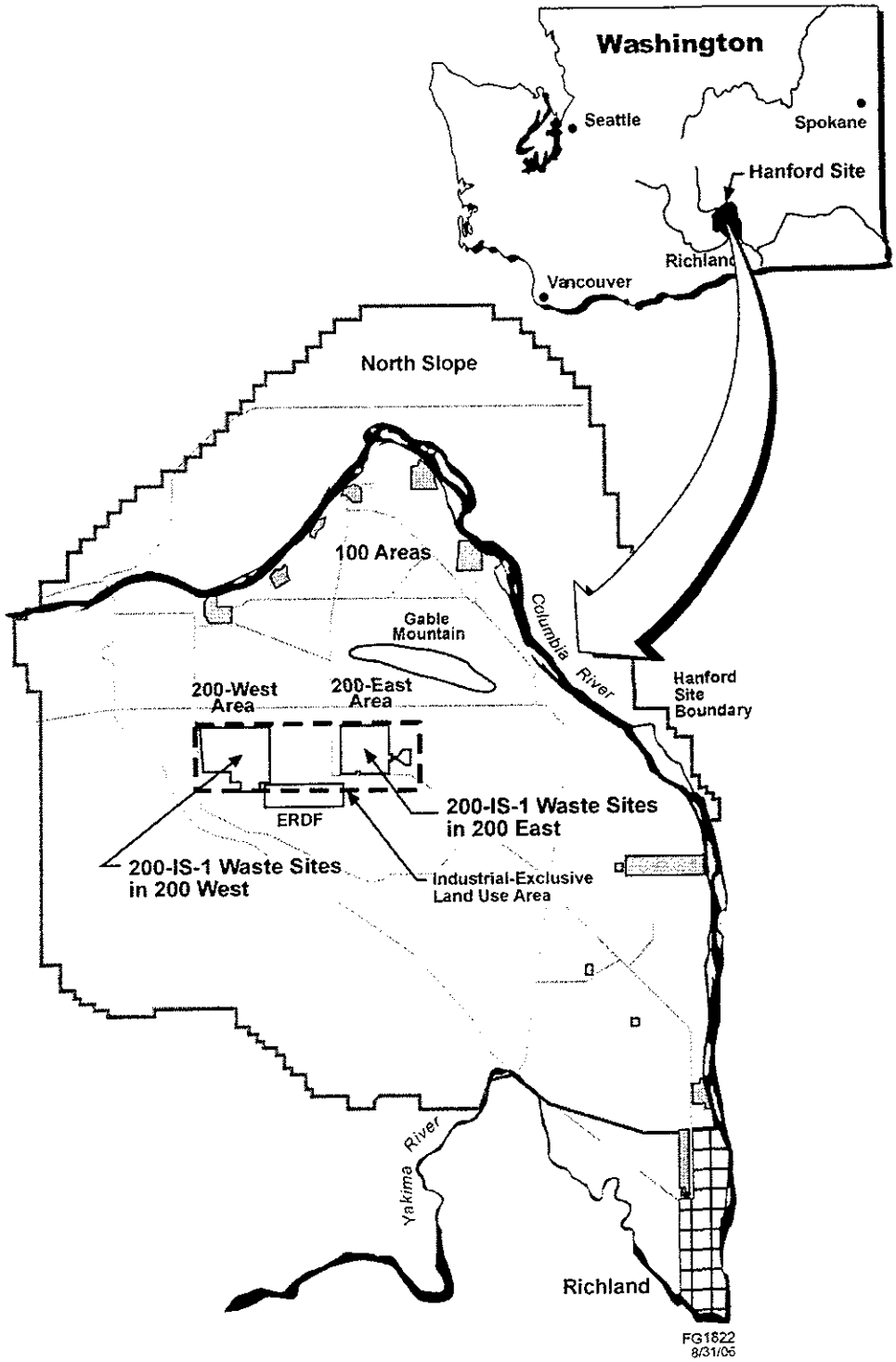
This summary report has been developed to support the remedial investigation/feasibility study (RI/FS) and remedial action decision-making processes for the 200-IS-1 Operable Unit (OU). This report supports the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) RI/FS activities for the 200-IS-1 Tanks/Lines/Pits/Boxes Waste Group OU. This OU is located mainly within the 200 Areas of the Hanford Site, but portions of the process pipeline systems extend outside the 200 Areas. The 200 Areas, and their designated industrial-exclusive land-use assumptions, are defined in DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, and the associated record of decision (ROD) (64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)"). The 200 Areas are part of the Hanford Site in south-central Washington State that are on the U.S. Environmental Protection Agency's (EPA) National Priorities List (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List,") under CERCLA (Figure 1-1). The general CERCLA RI/FS process is described in EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*, OSWER 9355.3-01. The application of the CERCLA RI/FS process in the 200 Areas is described in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan — Environmental Restoration Program* (hereinafter referred to as the Implementation Plan).

The original set of waste sites assigned to this OU in the Implementation Plan has been revised by the addition of new waste sites and the reclassification of accepted waste sites in accordance with RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)."

1.2 PROJECT SCOPE

The project scope includes the data quality objective (DQO) process and development of a sampling and analysis plan (SAP). The DQO process is a seven-step planning approach to develop sampling designs for data-collection activities that support decision making. The scope of this DQO summary report is limited to the inactive process-waste pipeline systems within the 200-IS-1 OU (i.e., pipelines, diversion boxes, catch tanks, related waste transfer infrastructure, and associated unplanned releases in surrounding soils). The DQO process does not include evaluation of waterlines, utility lines, inert gas lines, sanitary sewer, storm water, and aboveground pipelines or active pipelines.

Figure 1-1. Location of the Hanford Site and the 200 Areas.



1.3 PROJECT OBJECTIVES

The objectives of the DQO process for the 200-IS-1 OU process-waste pipeline systems within the Central Plateau include the following.

1. Determine the environmental measurements necessary to support the RI/FS process and remedial decision-making.

2. Address both human-health and ecological risks.

3. Identify potential remedial alternatives and consider them as part of the DQO development. The DQO process and subsequent SAP will support the collection of data that will be used to evaluate remedial alternatives and the need for treatability studies and to select a preferred alternative through the RI/FS process. Additional data uses may be to support waste acceptance for pipelines or soils that will be subject to removal, treatment, and disposal.

4. Ensure that the DQO summary report and SAP support development of the RI/FS work plan (DOE/RL-2002-14, *Tanks/Lines/Pits/Boxes/Septic Tank and Drain Fields Waste Group Operable Unit RI/FS/Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-IS-1 and 200-ST-1 Operable Units*).

5. Develop strategies that are inclusive of both *Resource Conservation and Recovery Act of 1976* (RCRA) and CERCLA requirements for 200-IS-1 OU process-waste pipeline systems within the Central Plateau.

6. Develop preliminary conceptual-contaminant-distribution model(s) that reflect the physical characteristics of the process waste pipeline systems and surrounding soil and the anticipated distribution of contaminants. Data collection will support refinement of the model(s).

7. Determine if releases could result in negative impacts to human health and ecological risks from surface to 4.6 m (15 ft) and to the underlying vadose zone in soil from 0 ft to groundwater.

8. Ensure that the conceptual-contaminant distribution and exposure models developed for the process-waste pipeline systems evaluate whether contaminant releases could result in a negative impact to groundwater (i.e., exceedance of maximum contaminant levels [MCL]).

9. Identify and modify, as needed, the contaminant-transport models and risk-assessment models.

10. Ensure that the data quality and type supports the models and the expected site-specific configurations (e.g., relatively large depth to groundwater) including treatment, storage, and disposal (TSD) units.

11. Document and support statistical approaches to decision-making.

1.4 PROJECT ASSUMPTIONS

- The DQO process will be conducted in accordance with EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, and Section 6.1 of the Implementation Plan (DOE/RL-98-28).

- Existing characterization data and process knowledge for process-waste pipeline systems within the 200-IS-1 OU and supporting data (e.g., characterization results from associated waste sites in other OUs) will be used in the DQO process and for preparing the RI/FS work plan.

- The remedial investigation (RI) (that is, initial OU characterization) will be used to refine the preliminary conceptual-contaminant-distribution model(s) for the process-waste pipeline systems. In the feasibility study (FS), the preliminary conceptual-contaminant-distribution models and the preliminary exposure model will be used to develop and evaluate remedial-action alternatives applicable to the OU.

- Additional characterization data may be needed to refine conceptual models to support the FS.

- Field screening characterization data will be collected when appropriate.

- While this DQO includes the screening of contaminants against ecological soil protection values, the ecological risk assessment being performed for the Central Plateau will stand as the ecological risk assessment for the 200-IS-1 and 200-ST-1 OUs.

Project-specific assumptions for the RI include the following.

- The 200-IS-1 OU is a source waste group. Investigations will focus on process-waste pipelines, pipeline structures, and their contents, as well as on the surrounding vadose-zone soil.

- The potential for transuranic radionuclides at waste-definition concentrations greater than 100 nCi/g may exist for process-waste pipeline systems in this OU. (Transuranic [TRU] waste is radioactive waste containing more than 100 nCi/g (3700 Bq/g) of alpha-emitting transuranic isotopes with half-lives greater than 20 years, other than the exceptions noted in DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*, Chapter 3, "Transuranic Waste Requirements").

- No preliminary conceptual-contaminant-distribution model(s) for the 200-IS-1 OU waste group was developed in DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*. Preliminary model(s) for process-waste pipeline systems will be developed as part of the DQO process.

- Remedial actions likely will be required for some 200-IS-1 OU process-waste pipeline systems to achieve applicable or relevant and appropriate requirements (ARAR), including soil cleanup standards of WAC 173-340, "Model Toxics Control Act -- Cleanup," for chemical contaminants. For the purpose of direct-exposure evaluations, process-waste pipeline systems in this OU that are outside the 200 Areas land-use boundary will use cleanup levels based on an unrestrictive land-use scenario. Evaluation of the potential to impact groundwater will include use of unrestricted soil-cleanup levels. Industrial soil-cleanup levels are defined in WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties," while unrestricted soil-cleanup levels are defined in WAC 173-340-740, "Unrestricted Land Use Soil Cleanup Standards." The radiological dose limits will be determined in the future. For the purposes of this DQO process, a dose range from 15 to 100 mrem/yr above natural background is applied for radionuclides in soil.

- Potential data uses that need to be considered when developing DQOs include refining the preliminary conceptual-contaminant-distribution model, remedial-action alternatives, remedial-action decisions, and risk assessment; and maintaining worker health and safety.

- The collected data will be used to support the disposal of investigation-derived waste (IDW). The data collected to solve the problem statement will support the designation of the IDW. However, before the RI is conducted, a separate DQO activity will be conducted to support waste designation. Any additional sampling requirements needed for waste designation will be identified at that time.

- Potential characteristic waste initially will be evaluated based on total analytical results. Toxicity characteristic leaching procedure (TCLP) analysis may be required if total results exceed or equal 20 times the regulatory standards identified in WAC 173-303-090, "Dangerous Waste Characteristics." TCLP results will be used for waste-designation determinations.

1.5 PROJECT ISSUES

Project issues include both the global issues that transcend the specific DQO project and the technical issues that are unique to the project. Both global and project technical issues have the potential to impact the sampling design or the DQOs for the project.

1.5.1 Global Issues

- The radiological dose limit for industrial land use is a global issue for this project, because the dose limit has not been established by decision-makers. This issue will be defined further in the FS process and documented in the ROD for the OU.

- During the DQO workshop held on 10/24/05, the Washington State Department of Ecology (Ecology) identified the following global issues.

1. Pertaining to characterization needed to be performed in support of the RI/FS process, the need to define the nature and extent of contamination during the RI/FS is a CERCLA requirement. This includes the lateral extent and depth of contamination. The lateral extent and depth of contamination are needed to perform the cost estimates that are required to evaluate different remedial alternatives. The lateral extent must be known to the degree necessary to calculate costs with an accuracy +50/-30 percent. Ecology acknowledges that they agree to the use of the analogous-site approach as identified in the 200 Areas Implementation Plan (DOE/RL-98-28), in appropriate circumstances. Ecology questions the use of this approach for pipelines.

2. Currently, there is no means for establishing consistent performance standards for RCRA past-practice pipelines and TSD pipelines that contain dangerous waste constituents, because of the latter's requirement for removal and decontamination to the extent practical, as defined in WAC 173-303-610(2).

3. A distinction needs to be made between pre- and post-1970 TRU material.

On October 11, 2006, Ecology identified additional global issues.

1. The 2nd sentence of the DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, (HCP) Record of Decision says:

   "The purpose of this land-use plan and its implementing policies and procedures is to facilitate decision-making about the site's uses and facilities over at least the next 50 years." [underline added for emphasis]

   The HCP also says that:

   "The designation of the Central Plateau for Industrial Exclusive use is consistent with its current management and operation and allows DOE to continue Waste Management operations in this area of the site and to expand existing facilities or develop new facilities to meet future mission needs."

   These DOE operations have a current regulatory dose limit of 5,000 mrem per year for trained DOE workers (10 CFR 835.202). DOE also has a requirement to restrict dose to visitors to 100 mrem per year (10 CFR 835.208); they do this through administrative controls, not cleanup levels.

   Therefore, we expect risk assessments to use a DOE worker scenario for the first 50 years. The applicable dose limit is 5000 mrem/year exposure to radioactivity. At this level within this time period, the remedy would still be protective. Again for DOE worker scenario, the Hazard Index for hazardous constituents must be < 1.0. The carcinogenic risk from non-radioactive dangerous waste constituents must be < 1x10-6 for individual chemicals, and < 1x10-5 cumulative. There is no groundwater pathway in the exposure scenario.

   An "industrial" (non-exclusive) exposure scenario applies between 50 and 150 years. Exposure to radioactivity must achieve a dose limit of 15 mrem/yr to be protective.

The Hazard Index for hazardous constituents must be < 1.0. The carcinogenic risk from non-radioactive dangerous waste constituents must be < 1x10-6 for individual chemicals, and < 1x10-5 cumulative. The groundwater pathway is not included directly. However, transport of waste site contaminants to the groundwater must achieve non-degradation standard.

After 150 years, the assumed land use is still industrial (non-exclusive). The applicable dose limit is still 15 mrem/year, which determines cleanup levels. We also evaluate intruder risk after 150 years, which should meet 15 mrem/year limits. Intruder risk is analyzed using a residential farmer scenario, and a construction worker/trenching scenario. Groundwater pathway is used. If these evaluations do not achieve 15 mrem/year, the feasibility will need to consider this in the evaluation of long-term effectiveness (1 of 9 CERCLA criteria).

A Native American Scenario should also be evaluated after 150 years. It should meet a 15 mrem/year dose limit. A groundwater pathway should be used.

2. Appendix C of the Hanford Federal Agreement and Consent Order Action Plan must be updated to reflect the current waste sites to be included in the 200-IS-1 Operable Unit.

3. Ecology advocates the use of wildlife, plants, and soil biota for industrial land use.

4. Ecology believes that the soil clean up levels should account for protection of surface water impacts by the pipelines on the Central Plateau.

1.5.2 Project Technical Issues

The project technical issues include the following.

- Characterization of the 200-IS-1 OU process-waste pipeline systems must consider radiological control requirements for possible TRU-contaminated soils. If contaminated soils are present above the TRU waste definition level in the process-waste pipeline systems, additional health and safety restrictions will be imposed on workers and work practices.

- Consistent protocols need to be established site-wide for dealing with data usability, including the use of data with qualifiers and non-detect data for risk assessment. DOE uses the latest version of EPA/540/1-89/002, *Risk Assessment Guidance for Superfund (RAGS), Volume I -- Human Health Evaluation Manual, (Part A) Interim Final,* OSWER 9285.7-01A, for usability of data including the use of data with qualifiers and non-detect data for risk assessment.

- Boundary issues (that is, waste site and contaminant responsibility) affecting characterization and remediation alternative evaluations need resolution.

- Technical issues impacting RI/FS work plan development identified by Ecology include the following.

- A decision-making process needs to be established for this project for residual nonradiological contamination inside of pipelines. This is because the WAC 173-340 standards pertain to soil contamination, not residual contamination inside of pipelines.

- 40 CFR 300.430(b)(3), "Remedial Investigation/Feasibility Study and Selection of Remedy," "Scoping," states "...the lead agency shall:...(3) Identify likely response scenarios and potentially applicable technologies and operable units that may address site problems." This DQO is focused on the 200-IS-1 OU. The work plan for this OU, DOE/RL-2002-14, will identify the likely response scenarios and applicable technologies.

On October 11, 2006, Ecology identified an additional technical issue.

- Resolve the comment on the use of congeners and detection limits for analysis of samples in this DQO (EPA Method 8082 vs 1668 in SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, as amended). The path forward on this issue is to propose a tiered approach with Aroclor[1] analysis serving as a screen. Only when Aroclors are present at a mutually agreed-to threshold concentration would congener analysis proceed.

1.6 WASTE SITES AND OPERATING HISTORY

The following facilities generated and stored waste streams for the 200-IS-1 OU process-waste pipeline systems:

- B Plant
- T Plant
- U Plant and Uranium Trioxide (UO_3) Plant
- Reduction-Oxidation (REDOX) Plant (S Plant)
- Plutonium-Uranium Extraction (PUREX) Plant (A Plant)
- Z Plant Complex
- Hot Semiworks Facility (C Plant)
- Tank farms, evaporators, and ancillary facilities.

Discussions of the U Plant and UO_3 Plant are included for completeness of information on process-waste operations. Pipelines located within the 200-UW-1 OU are not part of the 200-IS-1 OU process-waste pipeline systems.

[1] Aroclor is an expired trademark.

1.6.1 Plant History

The following discussion summarizes historical process operations at 200 Areas facilities that were associated with the 200-IS-1 OU process waste pipeline systems.

1.6.1.1 B Plant

Constructed in 1944, the B Plant Complex operated from 1945 to 1952, using the bismuth phosphate/lanthanum fluoride process to recover plutonium. The bismuth phosphate/lanthanum fluoride process steps were conducted in the 221-B Canyon Building as a series of batch-wise, inorganic chemical separation steps that removed plutonium from the dissolved irradiated uranium fuel rods. The lanthanum fluoride process was conducted in the 224-B Facility and further purified the plutonium. The 222-B Laboratory supported operations at the 221-B Canyon Building Complex and other 200 Areas facilities from 1945 to 1952.

Starting in 1952, the 221-B Plant was decontaminated and later refitted for waste treatment operations. In 1963, the Waste Fractionization Project began recovering strontium, cerium, and rare earth metals as part of Phase I processing. Phase I processing ended in June 1966 to accommodate Phase II construction, and Phase III waste fractionization processing began in 1968. This process separated the radionuclides Sr-90 and Cs-137 from high-level/high-activity PUREX and REDOX waste and stored a concentrated solution of Sr-90 and Cs-137 at the 221-B Building. Large quantities of tank wastes were transferred to B Plant for fission product recovery. In 1968, B Plant underwent further renovations, and the Waste Encapsulation and Storage Facility (WESF) was added to concentrate, encapsulate, and store radioactive waste. Waste fractionization and encapsulation continued until 1986 (DOE/RL-92-05, *B Plant Source Aggregate Area Management Study Report*).

1.6.1.2 T Plant

The T Plant was constructed from 1943 through 1944, and the bismuth phosphate/lanthanum fluoride process was used from 1945 to 1956 to recover plutonium. In 1957, the 221-T Canyon Building was converted to a decontamination and equipment refurbishment facility. The facility provided services in radioactive decontamination, reclamation, and decommissioning of process equipment, and it continues to serve the Hanford Site in this capacity. A series of testing programs by Pacific Northwest National Laboratory and Westinghouse Hanford Company occurred intermittently from 1964 to 1990 (DOE/RL-91-61, *T Plant Source Aggregate Area Management Study Report*). The 222-T Laboratory supported operations at the 221-T Building from 1945 to 1956. After 1956, all laboratory analyses of T Plant operations were sent to the 222-S Laboratory.

1.6.1.3 U Plant and Uranium Trioxide Plant

The U Plant was constructed in 1944 and included the 221-U Canyon Building, the 224-U Building, and the 222-U Laboratory. The U Plant's design matched that of the T and B Plants and initially was used to train personnel for the bismuth phosphate operations. For training only, water was used in the plant systems, and no waste was generated. In 1951, the U Plant was modified for the uranium recovery process (URP), which ran from 1952 to 1958. Uranium metal wastes from the bismuth phosphate process, stored in the single-shell tanks (SST), were

transferred to the 221-U Building where a large-scale solvent-extraction process was used to separate uranium from fission products. The process was the first to use tributyl phosphate (TBP) solvent in a normal paraffin hydrocarbon (NPH) diluent, later applied at the PUREX Facility. The residual high-activity wastes then were returned to the tank farms. In 1953, a "scavenging" step to precipitate Sr-90 and Cs-137 fission products was implemented in the URP operation. Following cessation of the URP, the 221-U Plant also performed equipment decontamination operations similar to those conducted at T Plant before the U Plant was decontaminated in 1966-1967 (DOE/RL-91-52, *U Plant Source Aggregate Area Management Study Report*).

The final operation of the URP was conducted in the 224-U Building. Uranyl nitrate hexahydrate (UNH) was calcined into UO_3 powder and packaged for shipment offsite. The facility also received uranium-bearing solutions from the 202-S REDOX Facility from 1951 until 1967, when that process was stopped. In 1957, the batch operation was updated to a continuous-flow calcining process, and the 224-U Building became known as the UO_3 Plant (DOE/RL-91-52). The UO_3 Plant also received PUREX uranium hexahydrate from 1958 to 1972, when PUREX was placed in "stand-down" mode. The UO_3 Plant resumed operations in 1984 to process UNH following the 1983 restart of the PUREX Plant. The UO_3 Plant operations ceased in 1988 (DOE/RL-2000-60, *Uranium-Rich/General Process Condensate and Process Waste Group Operable Units RI/FS Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-PW-2 and 200-PW-4 Operable Units*, Rev. 1, Reissue), except for a final 1993 run that processed PUREX waste generated during a 1992 cleanout run.

1.6.1.4 Reduction-Oxidation Plant (S Plant)

The REDOX process was conducted at the 202-S REDOX Plant (also known as S Plant) and was the first continuous separations process at the Hanford Site that recovered both uranium and plutonium. The process was based on a solvent-extraction technology that used methyl isobutyl ketone (MIBK, or hexone) and aluminum nitrate nonahydrate (ANN) in nitric acid to complete these separations. Plant operations began in 1952 and continued until 1967, when a fire in the plutonium purification column at the 233-S Plutonium Concentration Facility halted operations (DOE/RL-91-60, *S Plant Source Aggregate Area Management Study Report*).

The 222-S Laboratory currently is one of the primary waste generators in the REDOX area. The laboratory was constructed from 1950 through 1951 and is located immediately south of the 202-S Canyon Building. The laboratory provides high-, moderate-, and low-activity radiological and nonradiological analytical services for operations in the 200 Areas. The laboratory continues to support Hanford Site operations, with emphasis on waste management, offsite shipment certification, chemical processing, and environmental monitoring programs throughout the 200 West and 200 East Areas (including B Plant, U Plant, the tank farms, the 242-A and 242-S Evaporators, WESF, PUREX Plant, and Z Plant Complex operations).

1.6.1.5 Plutonium-Uranium Extraction Plant (A Plant)

The PUREX process was based on the same solvent extraction developed for the URP operation at U Plant. The separation process was conducted at the 202-A PUREX Plant. Started in 1955, it initially complimented and then replaced the REDOX process, operating continuously until

1972. The PUREX process used TBP in NPH and a recoverable salting agent (nitric acid) that proved economically more feasible, generated less waste, and operated more safely than the REDOX process. The PUREX Plant was placed in standby mode from 1972 until it was restarted in 1983, continuing operation until 1988. The internal piping and vessels were flushed out in a series of cleanout runs in 1992, and the facility then was deactivated. The 202-A Laboratory inside the 202-A Building supported PUREX operations from 1955 to 1972 and again from 1983 to 1988.

1.6.1.6 Z Plant Complex

The Z Plant Complex consists of two main buildings and numerous smaller facilities that were used to isolate and purify plutonium. Other processes produced metallic plutonium and plutonium oxides, milled and machined plutonium oxides and metals, and processed plutonium scrap materials. Various operations and experimental laboratories also supported the many missions of the Z Plant Complex. At present, the Z Plant Complex is being transitioned from a stabilization mission to deactivation and decommissioning as part of Plutonium Finishing Plant (PFP) site closure.

The 231-Z Building, also known as the Plutonium Isolation Facility (PIF) or the Concentration Building, was the final step for plutonium extracted in the B and T Plant bismuth phosphate process. It was constructed in 1944 and served to further purify plutonium-product solutions and convert them to a concentrated plutonium/nitrate paste before shipment offsite. With construction and startup of PFP in 1949, the 231-Z Building was converted into a plutonium metallurgy laboratory (Materials Engineering Laboratory) and operated in this capacity from the 1950s through 1970s. The U.S. Atomic Energy Commission's Division of Military Application used the facility between 1960 and 1975 to support testing programs at the Nevada Test Site. Gloveboxes, hoods, and other plutonium-containing equipment were decontaminated between 1978 and 1982. The 231-Z Building currently is in post-operation surveillance and maintenance mode and is awaiting closure.

In 1948, the 234-5 Z Building (PFP) and ancillary facilities were constructed to replace the isolation process in the 231-Z Building. A series of processes, or lines, were used to reduce plutonium nitrate to a metal or oxide form. The rubber glove (RG) line initially was used to reduce plutonium nitrate to metal and/or oxide forms beginning in 1949, using a batch, inorganic chemical process. The remote mechanical "A" (RMA) line operations replaced the RG operations in 1953 and continued until 1979. The remote mechanical "C" (RMC) line became operational in 1960 and continued until 1989. A remote mechanical "B" (RMB) line was built but never operated. The RMA and RMC used the same chemical process as the RG line; however, the RMA and RMC operations were conducted by operators using remote mechanical devices rather than rubber gloves within gloveboxes and hoods. The PFP also was used to fabricate plutonium metal into weapons shapes from the metal buttons produced in the RMA line operations from 1953 to the 1970s and in the RMC line operations from 1962 to the early 1990s. Process lines within the 234-5 Building have been deactivated, and the structure is awaiting remediation.

Scrap plutonium was reprocessed at several facilities between 1953 and 1987. The 234-5 Z Building housed the Recovery of Uranium and Plutonium by Extraction (RECUPLEX) process,

which used TBP in a carbon tetrachloride diluent. The RECUPLEX process operated from 1953 until a criticality ended operations in 1962. The Plutonium Reclamation Facility (PRF), located in the 236-Z Building, replaced RECUPLEX operations in 1964. The PRF operated until 1987 and recovered plutonium from scrap solutions and materials within the PFP and other DOE facilities using the same basic chemical separations reactions used in the RECUPLEX process.

The 242-Z Waste Treatment Facility housed the americium-recovery process line. The process was used from 1964 to 1976 to recover americium from the PFP process line when the ion-exchange (IX) column ceased operations. The 242-Z Waste Treatment Facility has been deactivated and is awaiting final closure.

The 241-Z Vault is located south of the 234-5 Z Building and houses equipment used to temporarily store and treat process effluents from PFP. The facility includes a series of five below-grade tanks set in individual concrete sumps (including four RCRA TSD units: D-4, D-5, D-7, and D-8). Also included are two above-grade tanks used to mix chemical additives.

1.6.1.7 Hot Semiworks Facility (C Plant)

The Hot Semiworks Facility (or C Plant) was the main experimental process engineering laboratory for the Hanford Site and was used to test separations processes using high-activity materials. The original site consisted of the 201-C Process Building, support facilities, and the 209-E Critical Mass Laboratory. At present, the 201-C Building has been dismantled to grade and is covered under a 2.4 to 3 m (8- to 10-ft) thickness of fly ash. The 209-E Critical Mass Laboratory, used to test configurations of TRUs to better quantify criticality parameters, is awaiting decontamination.

During its history, the Hot Semiworks Facility went through three distinct operational phases: (1) pilot-plant testing for the REDOX process, (2) pilot-plant testing for the PUREX process, and (3) pilot-plant testing for the strontium recovery process. The REDOX process studies took place between November 1952 and October 1953. Among other things, these studies evaluated dissolution and feed preparation, solvent-extraction processes, and process scavenging.

The PUREX process was studied intensively at the Hot Semiworks Facility between 1954 and 1957. Testing included processing irradiated slugs produced at the Hanford Site to recover plutonium and decontamination products. Among the aspects of the process investigated were process chemistry, properties of chemical solvents at different concentrations, solvent recycling, uranium-processing rates, solvent-extraction column performance, and decontamination deficiencies.

Hot semiworks studies for the purification of Sr-90 took place between 1961 and 1967. The strontium recovery process was performed via solvent extraction using a complexant di-2-ethyl-hexyl phosphoric acid (D2EHPA) to extract strontium from acid solutions of waste fuels (HW-72666, *Hot Semi-Works Strontium-90 Recovery Program*). Cerium, technetium, and promethium, as well as minor amounts of americium and curium in the final production run, also were extracted.

1.6.1.8 Tank Farms, Evaporators, and Ancillary Facilities

Since 1944, high-level wastes generated by the separations plants have been stored in 149 SSTs and 28 double-shell tanks (DST) within the 200 Areas. The 177 tanks are grouped into 12 SST and 6 DST tank farms. All tank farms and most ancillary equipment carry a "241-" prefix to identify their association with high-level/high-activity waste storage. The individual tank farms carry a letter code (A, B, C, S, T, and U), indicating the original processing plant from which the farm received waste. For remediation purposes, the 18 tank farms presently are grouped into one of seven tank Waste Management Areas (WMA), which include all facilities and equipment within the respective fence lines.

The B, C, T, and U Tank Farms initially were constructed in 1943 with twelve 2,006,050 L (530,000-gal) capacity, 22.9 m (75-ft) diameter 100-series tanks arranged in four, three-tank cascades. In addition, four 208,175 L (55,000-gal) capacity, 6.1 m (20-ft) diameter 200-series tanks also were built into each farm. All SST tanks are constructed of a single concrete vertical wall, with dished bottoms and curved plates joining the bases to the vertical sides. Four diversion boxes were constructed for each tank farm to route waste to individual tanks or tank cascades. The BX Tank Farm was built in 1947 for added storage capacity.

The operating capacity of these first-generation tank farms was quickly reached, and new second-generation tanks were constructed. Tanks built at the BY, S, TX, and TY Tank Farms between 1948 and 1953 each provided a 2,838,750 L (750,000-gal) storage capacity. These tanks have the same diameter and general construction as the first generation of tanks but have an increased working depth. Third-generation tanks were built between 1954 and 1963 at the A, AX, and SX Tank Farms. These tanks were designed to provide 3,785,000 L (1,000,000 gal) of storage capacity. Third-generation tanks have a different design and construction than earlier generations of tanks. With each new tank farm, additional diversion boxes were added, as well as additional pipelines and related ancillary equipment.

In 1966, the design of tanks changed from a single steel-lined concrete wall to an inner steel and outer concrete wall (or double-shell) design. Between 1966 and 1986, DST designs were used for the remaining six farms: SY, AN, AP, AW, AY, and AZ Tank Farms. These tanks are much smaller in size but have an increased capacity to handle high-heat loads associated with self-boiling, high-level/high-activity wastes generated at the REDOX and PUREX facilities.

Also associated with both the SST and DST tank farms are several tank evaporators or solidification systems. Large-scale evaporators were constructed near the B, T, S, and A Tank Farms.

- The 242-B Evaporator was constructed in 1951 to process first-cycle wastes from the bismuth phosphate process in the 241-B Tank Farm. The evaporator ran between December 1951 and November 1954, reclaiming over 26,530,000 L (7,000,000 gal) of tank space. The 242-B Evaporator was shut down in 1962. It was active thereafter supporting other activities but not necessarily evaporating tank waste.

- The 242-T Evaporator is located within the shared fence line of the TX and TY Tank Farms. The evaporator was constructed in 1950 and evaporated T, TX, and TY Tank Farm wastes between 1952 and 1956 and again between 1966 and 1976. It then was

converted for the neutralization of Z Plant wastes and later supported the salt-well pumping program until 1985. The 241-T Evaporator was shut down in 1976. It was active thereafter supporting other activities but not necessarily evaporating tank waste.

- The 242-S Evaporator, located north of and adjacent to the S Tank Farm, operated between 1973 and 1980 and was used to reduce waste volumes in the S and SX Tank Farms. The 242-S Evaporator currently is shut down and in a standby mode, but is not expected to be restarted.

- The 241-A Evaporator was built between 1974 and 1977 and is located in the southeast corner of the A Tank Farm. This evaporator is an integral, operating part of current and future (through 2018) waste retrieval and management activities. The 242-A Evaporator has been used to reduce the waste volume at a number of tank farms and has helped limit the number of DSTs required to store liquid waste generated at the Hanford Site.

Two in-tank-solidification (ITS) systems were installed the BY Tank Farm. ITS#1, which used heated air circulated through tank waste, was installed for Tanks 241-BY-101 and 241-BY-102 and began operation in 1965. ITS#2, using an in-tank heater, was installed first in Tanks 241-BY-111 and 241-BY-112 and operated between 1968 and 1974. The ITS#2 design was extended to the remaining BY Tank Farm tanks by 1971, and ITS#1 was converted to a cooler for ITS#2. The ITS process was superseded by salt-well pumping and was shut down in 1974.

Outside the tank farm fence lines, a great number of pipelines and ancillary equipment were constructed to support plant operations and waste transfers. At least 160.9 km (100 mi) of pipelines and numerous diversion boxes, catch tanks, and vaults are known. Pipelines used to transfer high-level/high-activity wastes initially were buried directly in trenches. A series of failures in the 1940s led to a design where up to 15 pipelines were placed in covered, below-ground concrete troughs, or encasements. The encasements extended between diversion boxes and were designed so that liquids lost in pipeline leaks drained into a diversion box or catch tank. Catch tank liquids could be pumped out and returned to the tank farm or processing facility. More recently, pipe-in-pipe designs have replaced encasements.

1.6.2 Process Information

The 200-IS-1 OU process waste pipeline systems received waste from several 200 Areas processes, including the following:

- Bismuth phosphate/lanthanum fluoride
- URP, UO_3 operations, and scavenging operations
- REDOX
- PUREX
- Isotope (strontium/cesium) separations, recovery, and storage operations

- PFP operations, machining, and plutonium/americium scrap recovery processes (i.e., RECUPLEX, PRF, and americium recovery)

- Tanks waste evaporation/solidification operations.

The processes conducted in the 200 Areas that generated the primary waste streams impacting 200-IS-1 OU process waste pipeline systems included the processes discussed in the following subsections.

1.6.2.1 Bismuth Phosphate/Lanthanum Fluoride

The bismuth phosphate process used sodium hydroxide to remove the aluminum cladding and concentrated nitric acid to dissolve the fuel rods. Bismuth phosphate and bismuth oxynitrate were used to support precipitation of plutonium; hydrogen peroxide, sodium dichromate, ferrous hydroxide, and ferrous ammonium sulfates were used to change the plutonium valence states during the oxidation/precipitation reactions. Phosphoric, sulfuric, and nitric acids were added to dissolve the precipitates that formed. In the bismuth phosphate process, the bismuth phosphate preferentially attracted plutonium from the solution; the plutonium, as a precipitate, was physically separated by centrifuging.

The lanthanum fluoride process further purified the dilute plutonium solution created in the last step of the bismuth phosphate process. The dilute plutonium nitrate supernatant was oxidized with sodium metabismuthate. Phosphoric acid was added to precipitate impurities, and the resulting solution was treated with oxalic and hydrofluoric acids and lanthanum salt. Consequently, lanthanum fluoride and plutonium fluorides were co-precipitated. The lanthanum and plutonium fluoride solids then were converted to hydroxides by the addition of a hot potassium hydroxide solution. The hydroxides were washed with water, dissolved in nitric acid, and heated to form a concentrated plutonium nitrate solution. This solution was sent to the 231-Z Plutonium Isolation Facility for further purification treatments and evaporation. A concentrated plutonium nitrate paste was the final product. Every 760 L (200-gal) batch of dilute, unpurified plutonium solution entering the 224-B or T Concentration Facility yielded an estimated 30 L (8 gal) of purified concentrated weapons-grade plutonium (HW-10475, *Hanford Engineer Works Technical Manual [T/B Plants]*).

1.6.2.2 Uranium Recovery Process, UO_3 Plant, and Scavenging Operations

The URP was implemented at the U Plant to recover the spent uranium from the metal waste and first-cycle waste streams generated during the bismuth phosphate process for reuse in weapons-grade plutonium production. The URP was performed in three phases. The first phase consisted of removing bismuth phosphate waste (i.e., metal waste, first-cycle supernatants, and cell 5 and 6 drainage) from the C, U, T, TX, TY, B, BX, and BY Tank Farms and preparing the sludge-slurry solution using nitric acid to dissolve the uranium metal and jet it into the U Plant. A second phase consisted of using a solvent-extraction process to separate the uranium from the remaining plutonium, fission products, and chemicals. The counter-current, solvent-extraction process used

TBP in an NPH diluent (e.g., AMSCO[2] or kerosene) that was less dense than water and assisted in the mass transfer of the separation process. Sulfamic acid and ferrous ammonia sulfate were used to ensure that the correct valence states of the uranium were obtained. The separated UNH then was sent to the 224-U Building (UO_3 Plant), where it was heated to approximately 204 °C (400 °F) to drive off nitrate and water, which resulted in UO_3 powder. The UO_3 powder was removed from the vessels, packaged, and shipped offsite, where it was then converted to uranium metal. The uranium metal was sent back to the Hanford Site 300 Area to be reincorporated into the uranium fuel rod production process (HW-19140, *Uranium Recovery Technical Manual*).

In 1953, tests were designed and conducted to separate the cesium and strontium from the URP aqueous waste streams generated during the bismuth phosphate campaign. A method was found to do so successfully. The "scavenging" process precipitated the long-lived fission products (including Sr-90 and Cs-137) from the waste solutions by the addition of a metal/ferrous cyanide complex. The metals that were most notable and most widely used to assist precipitation were iron, nickel, and cobalt. Calcium nitrate and/or strontium nitrate often were added to enhance the precipitation of Sr-90. Phosphate ions also were added to help the soil retain Sr-90. After the TBP waste had been scavenged, it was returned to the B, BX, BY, T, TX, and TY Tank Farms to allow the solids containing the fission products and scavenging chemicals to settle. The waste liquid was sampled from the tanks at various depths and analyzed before the liquid effluent was sent to cribs and/or trenches, depending on the concentrations of Cs-137 and Sr-90, or was rerouted to other nearby tanks where settling continued or "in-tank" scavenging occurred. In-tank scavenging actually was the addition of the ferrous cyanide complex to tank waste in tank farm vaults, not in tanks. The waste then was routed back to the tank, allowing it to settle. Samples of the supernatant were obtained. If the liquid was within "cribbable" or "trenchable" limits, the liquid then was routed out of the tank farm to vadose-zone disposal sites.

1.6.2.3 Reduction-Oxidation Process

The REDOX process was a solvent-extraction process that removed plutonium and uranium from dissolved fuel rods into an MIBK (or hexone) solvent. The solvent-extraction process was based on the preferential distribution of uranyl nitrate and the nitrates of plutonium between an aqueous phase and an immiscible organic phase (DOE/RL-91-60). The REDOX process included fuel decladding with a boiling sodium-hydroxide or sodium-nitrate solution for aluminum-based cladding or a boiling ammonium-fluoride and ammonium-nitrate solution for zirconium-based claddings. Feed dissolution using concentrated nitric acid, and plutonium oxidation using potassium permanganate and sodium dichromate were completed simultaneously. The prepared feed entered the packed, counter-current, solvent-extraction column where acidified hexone was fed to the column from the bottom and the aqueous phase (ANN scrub solution or salting agent) was fed to the column from the top. The aqueous solubility of the uranium and plutonium nitrates was reduced by increasing the nitrate concentration in the aqueous phase and modifying other reaction parameters (e.g., temperature, pH). The uranium and plutonium were extracted into the organic phase and routed to the second

[2] AMSCO is the trade name of a kerosene-based solvent (Allen Maintenance Supply Company, Inc., Allentown, Pennsylvania).

series of purification/extraction columns, while the fission products remained in the aqueous phase and were routed to the tank farms. Uranium and plutonium (present in the organic phase) were chemically separated in the second series of extraction columns using a ferrous sulfamate solution containing ANN, to reduce the plutonium to the +III valence state. Additional purification cycles of uranium and plutonium were conducted in the third series of extraction columns using the same chemical constituents. The solvent was recovered and recycled back into the process after treatment, sampling, and analysis (HW-18700, *REDOX Technical Manual*).

1.6.2.4 Plutonium-Uranium Extraction Process

The PUREX process used a recyclable salting agent (nitric acid, which greatly lessened the cost and the amount of waste generated) and TBP in an NPH solution as an extraction solvent. Fuel decladding was performed using a boiling sodium-hydroxide or sodium-nitrate solution for aluminum-based claddings or a boiling ammonium-fluoride and ammonium-nitrate solution for zirconium-based claddings. Feed dissolution used concentrated nitric acid and ANN. The prepared feed entered the pulsing, counter-current, solvent-extraction column where TBP diluted in NPH was fed to the column from the bottom and the aqueous phase (sodium-nitrite or nitric-acid salting-agent solution) was fed to the column from the top. Dilute nitric acid, ferrous sulfamate, and sulfamic acid descended from the top of the second column to remove uranium and neptunium from plutonium. Chemical separation processes were based on conducting multiple purification extraction operations on the resulting aqueous nitrate solutions containing each of the separated products in a second and third series of extraction columns, similar to REDOX operations. The driving forces for the separations consisted of varying partition coefficients between the aqueous and organic phases, controlled by valence-state changes of the element of interest (DOE/RL-92-04, *PUREX Plant Source Aggregate Area Management Study Report*). The solvent and salting agents (e.g., nitric acid) were recovered, treated, sampled, analyzed, and recycled back into the process operations.

1.6.2.5 Isotope (Strontium/Cesium) Separations, Recovery, and Storage Operations

The 221-B Canyon Building is one of the primary B Plant facilities. It began various waste treatment operations in 1965. In 1968, it was used in the isotope separations, recovery, and storage program to recover cesium and strontium. Since 1968, several new structures have been added to the 221-B Building, such as the 225-B WESF and the 212-B Cask Transfer Facility.

In 1963, the 221-B Building began recovering strontium, cerium, and rare earth metals using an acid-side, oxalate-precipitation process as part of the Phase I processing for the 221-B Building Waste Fractionalization Project. A centrifuge was used to separate the phases. The lead, cerium, and rare-earth fractions were dissolved in nitric acid and stored. The strontium fraction was thermally concentrated and stored. Portions of the strontium and rare earths produced in Phase I were pumped by underground transfer line to the 201-C Hot Semiworks Plant for purification of the Sr-90 fraction and separation of the rare-earth fraction in Ce-144 and a rare-earth fraction including Pm-147. Phase I processing at the 221-B Building ended in June 1966 to accommodate Phase II construction (DOE/RL-92-05).

The objective of Phase I processing was to restore services to the 221-B Building after its extended shutdown and to accumulate an inventory of fission products. The Phase II portion of

the project was the installation of facilities necessary to demonstrate a process system for packaging the long-lived fission products as a small-volume concentrated waste (Phase III). The purpose of Phase III was to provide waste fractionalization facilities in the 221-B Building for reprocessing high-level/high-activity wastes from the PUREX Plant and B Plant tank farms into fractions that could be immobilized and contained more safely (DOE/RL-92-05).

The Phase III waste fractionalization processing began at the 221-B Building in 1968. This process separated the long-lived radionuclides Sr-90 and Cs-137 from high-level PUREX and REDOX wastes and stored a concentrated solution of Sr-90 and Cs-137 at the 221-B Building. Individual tanks at the B Plant contained up to 35 MCi of Sr-90 and Cs-137 at concentrations up to 10,000 Ci/gal. The combined storage capacity of the tanks was estimated to be 85 MCi of Sr-90 and 25 MCi of Cs-137 (DOE/RL-92-05).

Three processes were used for the waste fractionalization. The first process was the feed preparation and solvent extraction of current acid wastes generated by the 202-A Building and stored at the PUREX Plant and REDOX tank farms. The solids in these wastes contained about 55 percent of the strontium and 70 percent of the rare earths. The solids, consisting mostly of silicates, phosphates, and sulfates, were treated by a carbonate-hydroxide metathesis solution to convert the sulfates to carbonate-hydroxide solids. These solids then were separated from the solution by centrifuge and dissolved in nitric acid to recover the fission products. The dissolved fission products were combined with original acid waste supernate after it had been treated to form feed for the solvent-extraction columns by adding a metal-ion complexing agent, a pH buffer, and a pH adjustment solution (DOE/RL-92-05).

The feed went through a series of solvent-extraction columns. The solvent used was a mixture of di(2-ethylhexyl) phosphoric acid extractant and TBP modifier in an NPH diluent. The strontium, cerium, and other rare earths were extracted from the aqueous phase into the solvent. The aqueous fraction contained the cesium and was routed to the A or AX Tank Farms at the PUREX Plant for temporary storage, to allow the decay of short-lived activity (DOE/RL-92-05).

The strontium fraction was stripped from the solvent with dilute nitric acid and thermally concentrated with the cell 5 concentrator for storage in tanks in the 221-B Building's cells 6 through 8. The cerium and rare-earth fraction was stripped from its solvent with nitric acid, combined with organic wash wastes, and sent to SST storage. The solvent was washed and recycled for reuse (DOE/RL-92-05).

The second process used was a feed preparation and solvent-extraction process for processing stored sludge wastes from the A, AX, and SX Tank Farms. The sludge was sluiced with supernate and water and then pumped out of the tanks to the 244-AR or 244-SR Vault. At these vaults, the sluicing water was decanted for storage to await treatment for cesium removal. The sludge, containing the bulk of the fission products, was dissolved in nitric acid and transferred to the 221-B Building for treatment (DOE/RL-92-05).

At the 221-B Building, the rare earths and strontium were precipitated as sulfates using lead sulfate as a carrier to separate them from iron and aluminum. A sodium hydroxide-sodium carbonate metathesis was performed to convert the sulfates to hydroxides and carbonates and to eliminate the bulk of the lead. The product cake was centrifuged, dissolved with nitric acid, and

accumulated for solvent-extraction treatment. The solvent extraction was similar to the solvent extraction for the current acid waste. However, the aqueous waste fraction from the initial solvent-extraction (containing the rare earths and the solvent wash) wastes were thermally concentrated at the 221-B Building using the cell 20 concentrator and transferred to immobilization processing (ITS) (DOE/RL-92-05).

The third waste fractionation process was the IX of stored cesium supernates and sluicing solutions. High-level tank farm supernates and sluicing water containing Cs-137 were passed through an IX column at the 221-B Building. The cesium and a small fraction of sodium were adsorbed on a synthetic alumino-silicate zeolite resin. About 97 percent of the adsorbed sodium and 0.5 percent of the loaded cesium were designed to be removed from the column with a dilute ammonium and carbonate-ammonium hydroxide scrub solution. Following this, the remaining cesium was removed with a concentrated mixture of ammonium carbonate and ammonium hydroxide. The cesium was thermally concentrated in the cell 20 concentrator and stored in tanks in 221-B Building cells 14 and 17. The waste from the adsorption step was routed directly to ITS. The column wash wastes and scrubs were thermally concentrated in the cell 23 concentrator before they were transferred to ITS. In 1974, the 221-B Building began using cell 38 to perform final purification of the cesium before processing at the WESF. The strontium solvent-extraction process operated until 1978. Cesium final purification was ended in 1983, and strontium purification was ended in 1984 (DOE/RL-92-05).

The waste fractionalization process included a thermal evaporation concentrator in cell 23 to concentrate process wastewater before it was disposed of. This system was used to concentrate low-level radioactive waste after the cesium and strontium waste fractionalization process was shut down in 1984. The DST waste was received at the 221-B Building for processing through the low-level waste concentrator until 1986. The 221-B Building did not receive DST wastes after April 1986, and processing of these wastes was completed by late 1986. Other sources of the low-level waste included miscellaneous sumps and drains in the WESF, which diverted decontamination waste solutions generated in the WESF process cells. Another contributor was a liquid collection system located beneath the 40 cells in the 221-B Building that collected cell drainage from decontamination work and water washdowns in the processing section of the 221-B Building (DOE/RL-92-05).

The concentrator process consisted of a vertical, single-pass, shell-and-tube, thermal-recirculated and steam-heated evaporator. The evaporator had two bundles of tubes that contained low-pressure steam to heat the process feed. The tube bundles heated the feed to the boiling point and vaporized it. The evaporated liquid passed through a high-efficiency deentrainer to remove entrained liquid droplets and was condensed as process condensate.

1.6.2.6 Z Plant/Plutonium Finishing Plant Operations

At the Z Plant Complex, the recovered, purified plutonium was refined to one of several forms, depending on the era and the available process.

The PIF process at the 231-Z Plutonium Isolation Facility was described as a batch-wise operation where concentrated plutonium nitrate solution was further reduced to a paste. The first step in the PIF process consisted of adding ammonium nitrate to the plutonium-nitrate solution

(received as the product from the T and B Plants), which reduced the plutonium to the (+IV) valence state. Next, sulfates and peroxide were added to the mixture, causing plutonium to precipitate as plutonium peroxide. Nitric acid was added to this precipitate, forming a purer and more concentrated plutonium-nitrate solution. Finally, this product was placed into small shipping containers and boiled, using hot air to evaporate the liquid to form a wet plutonium nitrate paste. The PIF process waste likely contained minor amounts of fission products, plutonium, and other TRU elements.

The 234-5 Z Plutonium Finishing Plant housed the RG line operations. The RG line operations were performed in batches through a series of gloveboxes in which the operators handled the radioactive materials directly, with their hands encased in rubber gloves. Several steps were involved with the RG line operations:

- Wet chemistry operations
- Dry chemistry operations
- Reduction to metal operations and casting
- Machining and review of product.

Plutonium feed in the form of a concentrated plutonium nitrate solution (produced in the T and B Plants [bismuth phosphate process], the 202-S Canyon Building [REDOX operations], and later the 202-A Canyon Building [PUREX operations]) was transferred to the 234-5 Z Plutonium Finishing Plant for the beginning of the wet chemistry operations. The chief impurities in the concentrated plutonium nitrate were lanthanum and americium. The first step in removing these impurities was to perform two peroxide precipitations to adjust the valence state of the plutonium from (IV) to (VI) to facilitate impurity removal. Aluminum then was added to complex the fluoride ions present in solution. After the second-cycle precipitation, the plutonium oxide was redissolved in nitric acid and concentrated by evaporation to plutonium nitrate.

The plutonium-nitrate solution was dissolved with hydroiodic acid in preparation for an oxalate strike. Dissolving the plutonium nitrate in hydroiodic acid changed the plutonium valence state from (IV) to (III). The oxalate was added with nitric acid and dilute peroxide, and a plutonium oxalate solid was formed. This solid was washed with a dilute solution of nitric and oxalic acid. The filtrate was treated with 4 percent potassium permanganate for 30 minutes at 65 °C. After the plutonium oxalate solid was washed, the dry chemistry operations began. The solid was dried at 120 °C to drive off the associated water. The temperature then was raised to 300 °C to convert the plutonium oxalate to plutonium oxide by calcination.

To produce the metal, plutonium oxide and any residual plutonium oxalate first were converted to plutonium fluoride by reactions with hydrogen fluoride. The hydrogen fluoride was added at high temperatures over time (refluxing), which allowed the reaction to proceed to 100 percent completion (production of plutonium fluoride). The plutonium fluoride then was placed in a container that was placed in a magnesium oxide crucible with calcium. A reducing charge was added to the crucible to convert the plutonium fluoride to plutonium metal at approximately 1,600 °C. Gallium was used to alloy the plutonium metal, to stabilize the delta phase during metal and oxide formation.

The liquid process waste was characterized as acidic and corrosive (pH of 2), high in salts, and low in organic content (except for the plutonium milling waste). The waste contained only

minor amounts of fission products and low concentrations of plutonium and other TRU elements (WHC-EP-0342, Addendum 8, *Plutonium Finishing Plant Wastewater Stream-Specific Report*). The waste was high in nitrates in the form of nitric acid, aluminum nitrate, magnesium nitrate, ferric nitrate, and calcium nitrate. Other components were aluminum fluoride, potassium hydroxide, potassium fluoride, chromium, lead, and trace metal ions.

Process wastes, including process condensates, were discharged through the 241-Z Waste Treatment Facility, where sodium hydroxide, ferric nitrate, and sodium nitrite were added to the waste liquids in tank D-5 for solubilization and neutralization. Corrosion inhibitors (e.g., sodium nitrite and aluminum compounds for solubilization) also were added in this tank. Before 1973, the waste was discharged via cribs to the soil column. Beginning in 1973, the treated waste was stored in underground SSTs and later in DSTs.

The RMA and RMC line operations replaced the RG line operation. The process remained the same chemically, so the waste also remained the same. Remotely operated mechanical equipment increased operation efficiency and reduced employee doses. The plutonium oxides were formed in magnesium-oxide crucibles. These hemispheres were reduced in the shape of a disk, or "button." The buttons were inspected and tested. From the early 1950s to late 1970s, the buttons were remelted and cast into a finished shape. Cast forms were coated with nickel and polished so that they could be handled without spreading plutonium contamination.

A mixture of lard oil and carbon tetrachloride was used for milling the plutonium metal. Other cutting solvents and hydraulic fluids (including polychlorinated biphenyls) also were used in the plutonium machine shop. The liquid process waste from the milling operations was characterized as high in organic content and contained only minor amounts of fission products and low concentrations of plutonium and other TRU elements. Milling-process waste, including process condensates, was discharged through the 241-Z Neutralization Tank (treatment tank D-5), where it was mixed with other 234-5 Z Canyon Building liquid process waste and had sodium hydroxide, ferric nitrate, and sodium nitrite added for solubilization and neutralization. Corrosion inhibitors (e.g., sodium nitrite and aluminum compounds for solubilization) also were added in this tank. Before 1973, the waste was discharged via cribs to the soil column. Beginning in 1973, this treated waste was stored in SSTs (and later in DSTs) and/or packaged in absorbent inside 207-L (55-gal) drums and routed to burial grounds in Low-Level Waste Management Areas (LLWMA) in the 200 West Area.

The RECUPLEX Facility was also housed in the 234-5 Z Building. The RECUPLEX Facility was used to purify plutonium scrap and solutions from 1955 to 1962. The process was a batch-wise, solvent-extraction technology based on the formation of an organic plutonium complex that was preferentially soluble in an organic solvent. This process used nitric and hydrofluoric acids to dissolve plutonium solids into plutonium nitrate liquid and a TBP-carbon tetrachloride solvent to recover plutonium from the plutonium-nitrate solutions. An 85:15 ratio by volume of carbon tetrachloride to TBP was used. Other ratios were tested during the pilot plant treatability tests, but the 85:15 ratio provided the most satisfactory results for recovering plutonium.

The PRF replaced the RECUPLEX process line after a criticality accident forced the closure of the RECUPLEX unit in April 1962. The PRF operated from 1964 to 1979 and again from 1984 to 1987 in the 236-Z Building. The PRF had essentially the same mission as the RECUPLEX

process line and used a similar solvent-extraction column technology. The extraction solvent used was carbon tetrachloride-TBP in an 80:20 ratio by volume, whereas the ratio in the RECUPLEX process was 85:15. Spent aqueous and organic wastes from the PRF were disposed to the soil column through a series of cribs until 1973.

The recovery of americium from PRF waste streams began in 1964 in the 242-Z Waste Treatment Facility. This facility was shut down in 1976 after a chemical explosion occurred in an IX column (known as the McCluskey incident). The americium recovery process used an IX technique to recover americium from the waste streams. Elution and regeneration of the IX resin was performed with nitric acid. Americium was recovered in the PRF using a dibutyl butyl phosphonate (DBBP) extractant in a carbon tetrachloride diluent. The DBBP was replaced in the process with TBP. Information on the waste generated from the americium recovery process was limited. Presumably, these waste streams would have included spent IX resins, organic solvent waste, and unrecovered americium, plutonium, uranium, and small amounts of fission products.

Currently, the Z Plant analytical and development laboratories are housed in the 234-5 Z Canyon Building. Analytical and development laboratories are reported to have been housed in the 231-Z Building as well. The laboratory provided analytical services and supported research and development activities for the various plutonium-finishing operations at the PFP (DOE/RL-2001-01, *Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit RI/FS Work Plan, Includes: 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Rev. 0, Reissue). This support was provided in the following ways:

- Quality assurance and quality control for the plutonium processing lines
- Liquid scintillation counting
- Preparation work for solvent-extraction tests.

1.6.2.7 Tank Farm Evaporation/Solidification Processes

Changes to concentration and composition of both chemical and radiological constituents occurred as new waste streams were routed into tanks with an existing inventory. As tank farm capacity was reached, various methods to reduce the volume of liquids were implemented.

- For a few streams with lower activity levels, the waste was allowed to settle and then was sampled. If analyses indicated that the liquid was within applicable limits, then the streams were discharged to cribs or trenches.

- Heating the waste to boil off excess liquid also was common and used both in-tank and free-standing evaporators built adjacent to the tank farms.

Each evaporation process required that one tank serve as the feed tank and that the concentrated wastes be returned to other tanks.

Wastes stored in the tank farms were recognized initially as a source for uranium and later for specific fission products. The resulting recovery processes required that tank wastes be mobilized and transported by pipelines to the process facility, where recovery of the target component was undertaken. These wastes usually required chemical additions to reduce the potential for clogging. The residual waste materials were returned to the same or other tank

farms for storage and again may have been treated to avoid undesirable chemical or physical reactions. Once the "scavenging" complexes had been added in the U Plant or in the tank farm vaults and the solids had settled, the liquid supernatants were sampled and routed to cribs and trenches.

To generate additional tank space, ITS or heaters were used in the BY Tank Farm, and initially two evaporators were constructed and used (242-T and 242-B Evaporators). Waste was routed from the feed tank to preheater (stainless-steel) tanks. The tanks had heating coils and were heated by steam produced during evaporator operations. In the evaporator, the feed was mixed with recycled liquid streams from the cyclone separator and the packed scrubber to prevent the precipitation of aluminum hydroxide and/or nitrates (known as "dry solids"). A slight vacuum often was applied to the system to assist boiling. Evaporated process supernatants, or "overheads," were routed to the cyclone separator and the packed scrubber. The resulting steam was sent back through the heating coils, and the condensed liquid was recycled back into the evaporator. The evaporator "bottoms," or slurries, were routed under pressure to the receiver tank and then to final storage (RL-SEP-396, *242-T Evaporator Facility Information Manual*).

Two additional evaporators (242-S and 242-A Evaporators) were constructed, and the vacuum evaporator-crystallizer process began in 1973. Basically, the feed was mixed with the recycled stream, as in the process above. However, the mixed feed entered the evaporation system through a pipe, where it then was heated by steam contacting the piping rather than by direct contact. Liquid was sent to a vapor-liquid separator that was maintained at 40 torr. Under this reduced pressure, a fraction of the water in the salt-slurry concentrate flashed to steam and was drawn through two wire-mesh, deentrainer pads in a vapor line and then proceeded to the condenser. As evaporation continued in the separator, supersaturation of the dissolved salts increased and crystallization occurred. To support this continuous-flow operation, the bulk of the slurry (consisting of salt cake and interstitial liquids) was retained and recirculated in the system while a small portion was routed to the selected slurry receiver tanks. The solids settled, and the supernate was pumped back into the evaporation system (ARH-F-101, *Vacuum Evaporator-Crystallizer Flowsheet for Waste Liquors*).

Within the evaporator, process off-gases and water vapor pass through one primary and two secondary condensers, creating the process condensate and a gaseous effluent. Gaseous effluents are filtered and released to the environment from the vessel ventilation exhaust system. Process condensate is collected in a condensate collection tank and pumped directly to the Liquid Effluent Retention Facility (LERF) or used in the process condensate recycle system. In the past, if the process condensate required additional cesium and strontium removal, it was processed though IX columns before discharge to the LERF. The IX columns have been removed, because treatment is provided at the Effluent Treatment Facility. Cooling water from the process vapor condensers and steam condensate stream is discharged to Treated Effluent Disposal Facility pump station #3 (HNF-14755, *Documented Safety Analysis for the 242-A Evaporator*). Two active diversion facilities associated with 242-A Evaporator operations are located in the SST A Tank Farm and the 241-A-A and 241-A-B Valve Pits.

As a result of these operations, it generally is assumed that most pipelines and diversion boxes directed a wide variety of high-level/high-activity wastes over a period of 40 plus years from plants to tank farms, between tank farms, and from tank farms to process buildings or

evaporators. Generally, no specific stream inventory can be directly attributed to a given line, and combinations of many 200 Areas waste stream residuum in the pipelines are possible. It also appears that standard practice dictated rinsing pipelines with several thousand gallons of water after a transfer was completed.

1.7 DATA QUALITY OBJECTIVES TEAM MEMBERS AND KEY DECISION MAKERS

Table 1-1 identifies the DQO development team members, and Table 1-2 identifies the key decision makers. The DQO workshop team members participated in the seven-step DQO process. The key decision makers provided external review of the results of the seven-step process.

Table 1-1. Data Quality Objectives Development Team Members.

Name	Organization	Area of Expertise (Role)
Doris Ayres	Fluor Hanford, Inc.	Analytical
Roy Bauer	Fluor Hanford, Inc.	Facilitator
Mike Hickey	Fluor Hanford, Inc.	Task Lead
Fred Ruck	Fluor Hanford, Inc.	Environmental Compliance
Steve Trent	Fluor Hanford, Inc.	Analytical
Chris Webb	Fluor Hanford, Inc.	WIDS
Lee Brouillard	GRAM Inc.	DQO Report Preparation
Janet Badden	CH2MHILL Hanford Group, Inc.	Task Lead
Michael Galgoul	CH2MHILL Hanford Group, Inc.	Technical
Les Fort	Washington State Department of Ecology	Engineering
Damon Delistraty	Washington State Department of Ecology	Risk Assessment
Brenda Jentzen	Washington State Department of Ecology	Task Lead
Beth Rochette	Washington State Department of Ecology	Risk Assessment
Jerry Yokel	Washington State Department of Ecology	Analytical
Kevin Leary	U.S. Department of Energy, Richland Operations Office	RL Task Lead

DQO = data quality objective. WIDS = *Waste Information Data System.*
RL = Richland Operations Office.

Table 1-2. Data Quality Objectives Key Decision Makers.

Name	Organization	Role
John Price	Washington State Department of Ecology	Ecology Project Manager
Roger Quintero	U.S. Department of Energy, Office of River Protection	ORP Project Manager
Matt McCormick	U.S. Department of Energy, Richland Operations Office	RL Assistant Manager for the Central Plateau

ORP = Office of River Protection. RL = Richland Operations Office.

1.8 EXISTING REFERENCES

Existing references identified for use in the evaluation of pipelines, diversion boxes, catch tanks, related waste transfer infrastructure, and associated unplanned releases in surrounding soils are listed in Table 1-3.

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
200 Areas Disposal Sites for Radioactive Liquid Wastes, ARH-947	Provides waste site and COPC information.
200 Areas Fact Book, TRAC-0238	Provides historical information on 200 Areas processes, decontamination activities, tanks, and laboratories; COPC information.
200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program, DOE/RL-98-28	Provides information on background geography, process, waste site, and COPC knowledge and strategy for the 200 Areas.
200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan, DOE/RL-2000-38	Provides historical and contaminant information on B, T, and U Plants and associated waste sites. Describes planned characterization in the 200-TW-1 and 200-TW-2 OUs.
216-Z-12 Transuranic Crib Characterization: Operational History and Distribution of Plutonium and Americium, RHO-ST-44	Provides data for the pipelines from the Z Plant 234-Z, 232-Z, 236-Z, 242-Z, and RECUPLEX processes to the 216-Z-12 Crib and summary of existing data for the 216-Z-12 Crib (pp 16, 18, 20). Describes characterization of transuranic cribs in the 200 Areas.
AX Tank Farm Waste Inventory Study for the Hanford Tanks Initiative Project, HNF-SD-HTI-TI-001	Estimates the radiological inventory associated with the AX Tank Farm. Describes the waste inventory of the AX Tank Farm.
B Plant Aggregate Area Management Study Technical Baseline Report, WHC-IP-0809	Provides waste unit descriptions including cribs, french drains, septic tanks, drain fields, trenches and ditches, ponds, catch tanks, settling tanks, diversion boxes, underground tank farms designed for high-level liquid wastes, and the lines and encasements that connect them. Waste sites are described separately.
B Plant Ion Exchange Feed Line Leak, ARH-1945	Provides summary of existing data for the V-122 line that leaked near the 241-C-152 Diversion Box.
B Plant Source Aggregate Area Management Study Report, DOE/RL-92-05	Provides waste unit descriptions; maps with locations of waste units; preliminary conceptual site exposure model; summary of waste-producing processes in B Plant; known and suspected contaminants; affected media; results of soil, vadose zone, water, and biota sampling; plant buildings and waste discharge units (e.g., tanks, wells, vaults, ponds, ditches, trenches, septic systems, transfer lines and associated equipment, retention basins, liquid effluent retention facilities); and site hazard rankings. Process history of B Plant aggregate area, waste management operations history, chemical waste inventories estimates, and history of UPRs.
Borehole Summary Report for the 200-UP-2 Operable Unit, 200 West Area, BHI-00034	Provides soil sampling and analysis data for the 200-UP-2 Groundwater OU.
Central Plateau Ecological Evaluation, DOE/RL-2001-54	Describes the ecological evaluation and approach for the 200 Areas.
Cross-Site Transfer System Disposition Study, RPP-20605	Provides information on the 241-UX-154 Diversion Box, which drains to the 241-UX-302A Catch Tank (p 2-2).

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells, ARH-ST-156	Includes collection of geophysical gamma logs and interpretations.
Existing Data On the 216-Z Liquid Waste Sites, RHO-LD-114	Provides data for the effluent pipeline from Z Plant (234-Z5, 236-Z, and 242-Z Buildings) into the 216- Z-2 Crib, and between the 216-Z-2 and 216-Z-1 Cribs (pp 13-14) and summary of existing data for the 216-Z-1 and -2 Cribs and the 216-Z-1A Tile Field. Also 216-Z-3 Crib overflow into the 216-Z-1A Tile Field (p 24).
Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement, DOE/EIS-0222-F	Contains the land-use plan for the Hanford Site.
Final Report for the Remote CCTV Survey of Abandoned Process Effluent Drain Lines 840 and 840D in Support of the 200 West Area Carbon Tetrachloride ERA, WHC-SD-NR-ER-103	Provides summary of existing data for the lines out to the 216-Z-9 Crib.
Geohydrology of the 218-W-5 Burial Ground, 200-West Area, Hanford Site, PNL-7336	Contains geological information.
Geologic Setting of the Low-Level Burial Grounds, WHC-SD-EN-TI-290	Contains geological information.
Handbook 200 Areas Waste Sites, 3 vol., RHO-CD-673	Provides waste site descriptions, releases, waste discharge information, and management reports. Presents 200 Area waste site information. Describes 200 Area waste site information.
Hanford Engineer Works Technical Manual (T/B Plants), Parts A, B, and C, HW-10475	Provides process information on B, T, and U Plant facilities, chemicals used or stored, and operation and maintenance information, including process effluent sampling/analysis methods and theory behind the materials, chemicals, and equipment used during the bismuth-phosphate campaign. Results in this reference include general designation of waste streams generated and conclusive evidence that the bismuth-phosphate separation and the lanthanum-fluoride purification processes were strictly inorganic in chemical nature.
Hanford Environmental Information System, Hanford Site database	Contains borehole information and sampling data.
Hanford Site Atlas, BHI-01119	Provides Hanford Site maps.
Hanford Site Groundwater Monitoring for Fiscal Year 1999, PNNL-13116	Describes groundwater monitoring on the Hanford Site.
Hanford Site Groundwater Monitoring for Fiscal Year 2001, PNNL-13788	Describes groundwater monitoring on the Hanford Site.
Hanford Site Groundwater Monitoring for Fiscal Year 2003, PNNL-14548	Describes groundwater monitoring on the Hanford Site.
Hanford Site Water Changes 1950 Through 1980 -- Data Observation and Evaluation, PNL-5506	Contains groundwater maps of the Hanford Site.
Hanford Tank Chemical and Radionuclide Inventories: HDW Model, LA-UR-96-3860	Provides scavenged and URP process waste and COPC comparisons.

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
Historical Vadose Zone Contamination from A, AX, and C Tank Farm Operations, RPP-7494	Summary of historical vadose zone contamination in the A, AX, and C Tank Farms.
History and Stabilization of the Plutonium Finishing Plant (PFP) Complex, Hanford Site, HNF-EP-0924	Provides historical account of process operations information for Z Plant and ancillary facilities, and feed process modifications at REDOX, PUREX, and T and B Plants. Information on trouble encountered, solutions implemented, chemical used, an overview of each process's daily activities, building construction, functions, maintenance, and sampling, laboratory, and disposal activities.
History of Operations (1 January 1944 to 20 March 1945), OUT-1465	Provides historical account of process operations information in the 100, 200, and 300 Areas. Includes information on trouble encountered, solutions implemented, chemical inventories, an overview of the daily activities for each process, building construction, functions, maintenance, and sampling, laboratory, and disposal activities.
Hot Semiworks REDOX Studies, HW-31767	Presents background information on the Hot Semiworks and REDOX processes.
Hot Semi-Works Strontium-90 Recovery Program, HW-72666	Describes the Hot Semiworks Sr-90 recovery program.
Hydrogeologic Model for the 200-East Groundwater Aggregate Area, WHC-SD-EN-TI-019	Provides groundwater and geological information for 200 East Area waste sites.
Hydrogeologic Model for the 200 West Groundwater Aggregate Area, WHC-SD-EN-TI-014	Provides groundwater and geological information for 200 West Area waste sites.
Inventory of Chemicals Used at Hanford Site Production Plants and Support Operations (1944-1980), WHC-EP-0172	Includes list of chemicals used in processing plants and supporting facilities, including laboratories in the 200 and 300 Areas.
Limited Field Investigation for the 200-UP-2 Operable Unit, DOE/RL-95-13	Describes the characterization of the 200-UP-2 Groundwater OU.
Miocene- to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington, BHI-00184	Describes the geology of the sediments above the basalt on the Hanford Site.
Miscellaneous Underground Radioactive Waste Tanks, WHC-EP-0560	Describes the history of miscellaneous underground radioactive waste tanks.
Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management Areas, DOE/RL-99-36	Work plan for single-shell tanks
Phase I Remedial Investigation Report for 200-BP-1 Operable Unit, DOE/RL-92-70	Describes 200-BP-1 OU data collection, analysis, and results, including discussion of the nature and extent of contamination, a baseline risk assessment, and column leach and sorption testing.
Plutonium Finishing Plant Wastewater Stream-Specific Report, WHC-EP-0342, Addendum 8	Describes the waste stream chemistry of the Plutonium Finishing Plant.

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit RI/FS Work Plan, Includes: 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2001-01, Rev. 0, Reissue	Provides historical and contaminant information on the 200-PW-1 OU representative waste sites. PUREX processes and associated waste sites.
PNLATLAS/LG-ARCHV/200 EAST and WEST	Database for geophysical logging.
"PSS Line Leak (Line No. 812)," Metz 1972	Describes the process sludge supernate line leak.
PUREX Chemical Flowsheet HW Number 3 Chemical Development Unit Separations Technology Subsection Technical Sec Engineering Department, HW-31373	Describes process chemistry associated with PUREX.
PUREX Source Aggregate Area Management Study Report, DOE/RL-92-04	Provides waste unit descriptions including cribs, french drains, septic tanks, drain fields, trenches and ditches, ponds, catch tanks, settling tanks, diversion boxes, underground tank farms designed for high-level liquid wastes, and the lines and encasements that connect them. Waste sites are described separately.
PUREX Technical Manual, HW-31000-DEL	Contains process information on PUREX Plant facilities, chemicals used or stored, and operations and maintenance information including process effluent sampling/analysis methods and theory behind the materials, chemicals, and equipment used during the PUREX process.
Radioactive Contamination in Liquid Wastes Discharged to Ground Within the Chemical Separations Area Control Zone Through 1969, ARH-1608	Summarizes radioactive contamination in liquid wastes discharged to the ground in the 200 Areas.
Radioactivity in Gaseous Waste Discharged from the Separations Facilities During 1972, Parts 1 through 4, ARH-2757	Summarizes gaseous discharges from the separations facilities.
Radioactive Liquid Waste Disposal Facilities--200 West Area, ARH-2155	Provides summary of existing data for the various pipelines associated with the Z Ditches cooling water/chemical sewer system.
Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site, HNF-1744	Provides waste site and COPC information.
RCRA Facility Investigation/Corrective Measures Study Work Plan for the 200-UP-2 Operable Unit, Hanford Site, Richland, Washington, DOE/RL-91-19	Describes the operable unit setting and the objectives, procedures, task, and schedule for conducting RCRA facility investigation/corrective measure study.
Recovery of Cesium-137 from Uranium Recovery Process Wastes, HW-31442	Provides history of operations, process information of source facilities, and chemicals used or stored. Lists COPC information.
REDOX Technical Manual, HW-18700-DEL	Provides process information on S Plant facilities, chemicals used or stored, and operations and maintenance information including process effluent sampling/analysis methods and theory behind the materials, chemicals, and equipment used during the REDOX process.

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
Remedial Investigation for: the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units, DOE/RL-2003-11	Includes characterization of pipeline from the 231-Z Building to the Z Ditches.
Report on Plutonium Mining Activities at 216-Z-9 Enclosed Trench, RHO-ST-21	Describes mining efforts to recover plutonium from the 216-Z-9 Trench.
Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site, RPP-25113	Identifies 100 pipelines that have failed at the Hanford Site. Ten waste transfer lines are identified within the fenceline of WMAs, are known to have failed because of plugging, and are assumed to contain residual waste. Pipeline routings and waste transaction records are combined with historical references to determine the time frame and waste types most likely involved in each pipeline pluggage incident. Residual waste composition estimates for the plugged pipelines are summarized.
S Plant Source Aggregate Area Management Study Report, DOE/RL-91-60	Provides waste unit descriptions including cribs, french drains, septic tanks, drain fields, trenches and ditches, ponds, catch tanks, settling tanks, diversion boxes, underground tank farms designed for high-level liquid wastes, and the lines and encasements that connect them. Waste sites are described separately.
Semiworks Aggregate Area Management Study, WHC-SD-EN-ES-019	Provides waste unit descriptions including cribs, french drains, septic tanks, drain fields, trenches and ditches, ponds, catch tanks, settling tanks, diversion boxes, underground tank farms designed for high-level liquid wastes, and the lines and encasements that connect them. Waste sites are described separately.
Semiworks Plant Source Aggregate Area Management Study Report, DOE/RL-92-18	Provides waste unit descriptions including cribs, french drains, septic tanks, drain fields, trenches and ditches, ponds, catch tanks, settling tanks, diversion boxes, underground tank farms designed for high-level liquid wastes, and the lines and encasements that connect them. Waste sites are described separately.
Standby Status Report Hot Semiworks Facility, HW-52860	Describes the condition of the Hot Semiworks facility when it was in standby status.
Subsurface Conditions Description of the B-BX-BY Waste Management Area, HNF-5507	Describes characterization of the B-BX-BY Tank Farms.
Subsurface Conditions Description of the T-TX-TY Waste Management Area, RPP-7123	Describes characterization of the T-TX-TY Tank Farms.
Supporting Document for the Historical Tank Content Estimate for A Tank Farm, WHC-SD-WM-ER-308	Describes chemical inventory of A Tank Farm.
Surface and Near Surface Field Investigation Data Summary Report for the 200-UP-2 Operable Unit, BHI-00033	Provides a summary of 200-UP-2 OU surface and near surface soil sampling results.

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
T Plant Aggregate Area Management Study Technical Baseline Report, BHI-00177	Provides waste unit descriptions including cribs, french drains, septic tanks, drain fields, trenches and ditches, ponds, catch tanks, settling tanks, diversion boxes, underground tank farms designed for high-level liquid wastes, and the lines and encasements that connect them. Waste sites are described separately.
T Plant Source Aggregate Area Management Study Report, DOE/RL-91-61	Provides waste unit descriptions; maps with locations of waste units; preliminary conceptual site exposure model; summary of waste-producing processes in T Plant; known and suspected contaminants; affected media; results of soil, vadose zone, water, and biota sampling; plant buildings and waste discharge units (e.g., tanks, wells, vaults, ponds, ditches, trenches, septic systems, transfer lines and associated equipment, retention basins, liquid effluent retention facilities); and site hazard rankings. Process history of T Plant aggregate area, waste management operations history, chemical waste inventories estimates, and history of UPRs.
Tabulation of Radioactive Liquid Waste Disposal Facilities, HW-33305	Identifies radioactive liquid waste disposal facilities.
Tank Farm Ancillary Equipment Disposition Study, RPP-20604	Provides data for Waste Management Area C, including limited information on the 200-E-111 Pipeline.
Best-Basis Inventory, Hanford Site database	The *Best-Basis Inventory* is the official database for tank waste inventory estimates at the U.S. Department of Energy (DOE) Hanford Site. Estimates are based on the "best" available information to describe in-tank waste contents. This includes sample-based information, when available, process knowledge calculations and waste type templates based on sample data and the waste estimates in RPP-19822, *Hanford Defined Waste Model – Revision 5.0*).
Tank Wastes Discharge Directly to the Soil at the Hanford Site, WHC-MR-0227	Provides descriptions of waste units, site locations, and waste type summaries. Conclusions from previous studies, general model of contaminant distributions for cribs and trenches, and process information overview. Describes tank waste discharged to the soil column at the Hanford Site.
The Safety Analysis Report for the Decontamination and Decommissioning of the Strontium Semiworks Complex, SD-WM-SAR-003	Presents the safety analysis supporting decontamination and decommissioning of the Hot Semiworks complex.
U Plant Aggregate Area Management Study Technical Baseline Report, BHI-00174	Provides waste unit descriptions including cribs, french drains, septic tanks, drain fields, trenches and ditches, ponds, catch tanks, settling tanks, diversion boxes, underground tank farms designed for high-level liquid wastes, and the lines and encasements that connect them. Waste sites are described separately.
U Plant Source Aggregate Area Management Study Report, DOE/RL-91-52	Contains process information on U Plant facilities, radionuclides. and nonradiological constituents used and discharged, known and suspected contaminants, and a list of COPCs.

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
Uranium Recovery Technical Manual, HW-19140	Provides process information on U Plant facilities, chemicals used or stored, and operations and maintenance information, including process effluent sampling/analysis methods and theory behind the materials, chemicals, and equipment used during the URP campaign. Results include general designation of waste streams generated and conclusive evidence that the URP separation and the supplementary purification processes were strictly inorganic in chemical nature with the exception of TBP diluted in normal hydrocarbon paraffin.
Uranium-Rich/General Process Condensate and Process Waste Group Operable Units RI/FS Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-PW-2 and 200-PW-4 Operable Units, DOE/RL-2000-60, Rev. 1, Reissue	Provides historical and contaminant information on the 200-PW-2 OU representative waste sites. This work plan also includes a sampling and analysis plan. REDOX processes and associated waste sites. Provides existing data for the 216-B-12 Crib; mention of associated piping from 221-U, 224-U, and 221-B Buildings (2.2.3.2) into the 216-B-12 Crib.
Waste Information Data System	Hanford Site database; summarizes site name, location, type, status, site and process descriptions, associated structures, clean-up activities, environmental monitoring description, access requirements, references, regulatory information, and waste information (e.g., type, category, physical state, description, stabilizing activities).
Waste Site Grouping for 200 Areas Soil Investigations, DOE/RL-96-81	Summarizes site name, location, type status, site and process descriptions, known and suspected contamination, preliminary contaminant distribution conceptual model, site conditions that may affect COPC fate and transport, COPC mobility in Hanford Site soils, COPC distribution and transport to groundwater, and hazards associated with COPCs. Soil porosity information for each waste site.
Z Plant Source Aggregate Area Management Study Report, DOE/RL-91-58	Includes soil and geological information, COPC information, process history, and geophysical logging.
Drawings (Lists)	**Construction "As-Built" Drawings**
H-2-1495, *200 West Area Steam Line Plot Plan*	200 West Area Steam Line Plot Plan
T Plant and Associated Facilities	
H-2-353, *Waste Disposal Cribs, 216-T-6, 216-T-8 Cribs and Reverse Wells 216-T-3 and T-2*	Construction drawings for 216-T-2, 216-T-3, 216-T-6, 216-T-8 Cribs, T Plant
H-2-840, *Diversion Box Catch Tank & Piping at 241-TX-155*	241-TX-155 Piping Layout
H-2-843, *Diversion Box & Piping Layout*	241-TX-155 Piping Layout
H-2-2236, *Waste Line Plan & Profile*	241-TY Piping Layout
H-2-2536, *Catch Tank and Piping Replacement at Diversion Box 241-TX-155*	241-TX-155 Catch Tank Piping Layout
H-2-32096, *Decontamination Waste Crib Plans & Profiles*, Rev. 2	216-T-33 Construction drawing
H-2-32097, *Decontamination Waste Crib Sections and Details*, Rev. 1	216-T-33 Construction drawing

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
H-2-42383, *Piping - Booster Pump Pit - Plan and Sections*, Sheet 1	241-TR-153 Pump Pit Plan and Section
H-2-42390, *Piping – Underground Process Plan & Sections*, Sheet #1	241-TR-152 Piping Layout, T Plant
H-2-42391, *Piping – Underground Process Plan and Section*, Sheet #2	241-TR-151 Piping Layout, T Plant
H-2-42496, *Piping Arrangement – Master Diversion Box - Plan & Elevation*	241-TXR-151 Piping Layout, T Plant
H-2-44511, *Area Map 200 West "T" Plant Facilities*, Sheet 109	Location Map of T Plant Facilities
H-2-44511, *Area Map 200 West "T"-Plant Facilities*, Rev. 5, Sheet 110	Location Map of T Plant Facilities
H-2-44511, *Area Map 200 West T Plant Facilities*, Rev. 9, Sheet 118	Location Map of T Plant Facilities
H-2-44511, *Area Map 200 West "T"-Plant Facilities*, Rev. 5, Sheet 126	Location Map of T Plant Facilities
H-2-44511, *Area Map 200 West T Plant Facilities*, Rev. 9, Sheet 132	Construction drawing for T Plant Facility
H-2-44511, *Area Map 200 West "T" Plant Facilities*, Rev. 5 Sheet 134	Location Map of T Plant Facilities
H-2-44511, *Area Map 200 West "T"-Plant Facilities*, Rev. 10, Sheet 140	Location Map of T Plant Facilities
SK-2-2419, *Catch Tank and Piping Replacement at Diversion Box 241- TX-155*	241-TX-155 Piping Layout
A Plant and Associated Facilities	
H-2-56050, *Underground Rock Cribs 216-A-2, 216-A-3, 216-A-4, 216-A-5*, Sheet 1	Construction drawing for Cribs 216-A-2, 216-A-3, 216-A-4, 216-A-5 Cribs
B Plant and Associated Facilities	
H-2-612, *Arrangement & Piping Diversion Box 241-BX-153*	241-BX-153 Piping Layout
H-2-618, *Catch Tank Arrangement E.P. 241-BX-302-A*	Construction Drawing
H-2-629, *Diversion Box 241-154 BX Piping Conn to 221-B & 241-BX*	221-B and 241-BX-154 Piping Layout
H-2-635, *Catch Tank Arr'g't. EQ. P.C. 241 BX-302-B*	Construction Drawing
H-2-638, *Diversion Box 241-155 BX Arrangement & Piping*	241-BX-155 Piping Layout
H-2-939, *Waste Line Arrgt & Details Sht.V*	241-BX-154 Waste Line Details
W-72183, *Diversion Boxes 241-B-51 and 241- B-152 Arr Piping*, Sheet 3	241-B-151 and 241-B-152 Piping Layout
H-2-432, *Piping Between 241B and 241C*	241-B and 241-C Piping Layout
H-2-32886, *Promethium Transfer Line Plan, Profile & Detail Sheet 3*	201C-221B Construction Drawing of Transfer lines

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary
C Plant and Associated Facilities	
H-2-2537, *241-ER-311 Catch T and Piping Replacement at Diversion Box 241-ER-151*	241-ER-311 and 241-ER-151 Piping Layout
H-2-4535, *Site Plan & Underground Piping Strontium Facilities Hot Semiworks*	Plot Plan
H-2-4010, *Strontium Semiworks and Vicinity Outside Lines Key Map*	Line Key Map
H-2-4420, *Plot Plan Hot Semiworks Waste Self Concentrator*	Plot Plan
H-2-32523, *"C" Plant Liquid Waste Disposal Sites, 216 "C" Series*	Drawing shows locations of 216-C-1 through 216-C-10 Cribs
H-2-43031, *Abandoned Catch Tank at Diversion Box 241-ER-151 Piping Arrangement*	241-ER-151 Piping Layout
H-2-43036, *Diversion Box 241 ER-151 Piping Layout*	241-ER-151 Piping Layout
H-2-43108, *9'-0 Dia. x 40' Mild Steel Catch Tank at 241-ER-151 Catch Tank*	241-ER-151 Construction Drawing
H-2-44301, *Plot Plan and Piping*, Rev. 4, Sheet 1	209-E Plot Plan
H-2-44335, *Outside Lines Key Plan and Details*, Rev. 4	209-E Key Plan
H-2-44356, *Equipment Waste and Process Drains Service & Control Building*, Rev. 3	209-E Piping Layout
H-2-44501, *Area Map 200 East "C" Plant Facilities*, Rev. 6, Sheet. 82	Location Map of C Plant Facilities
H-2-71670, *Piping Enlgd Plan & Sect 241-ER-151 and 241-ER-311*	241-ER-151 and 241-ER-311 Piping Layout
S Plant and Associated Facilities	
H-2-39955, *Structural Compressor House*	241-SX-701 As-built of Compressor House
H-2-44511, *Area Map 200 West "S" Plant Facilities*, Sheet 38	Location Map of S Plant Facilities
H-2-72885, *Decontamination Trailer & Radiation Monitoring Tank*	272-S Section of Decontamination Trailer and Monitoring Tank
H-2-95401, *Ventilation Upgrade Compressor Bldg.*, Rev. 0, Sheets 1 and 2	241-SX-701 Construction drawings for Ventilation Upgrade
U Plant and Associated Facilities	
H-2-44004, *216-U-3 Crib Details 241-U Steam Condenser Water and Drain Piping*, Sheet 1	216-U-3 Crib Details and 241-U Steam Condenser Water and Drain Piping

Table 1-3. Existing Documents and Data Sources. (10 Pages)

Reference (full citations in Chapter 8.0)	Summary

COPC = contaminant of potential concern.
HEIS = *Hanford Environmental Information System.*
OU = operable unit.
PUREX = Plutonium-Uranium Extraction.
RCRA = *Resource Conservation and Recovery Act of 1976.*
RECUPLEX = Recovery of Uranium and Plutonium by Extraction.
REDOX = Reduction-Oxidation.
TBP = tributyl phosphate.
UPR = unplanned release.
URP = *uranium recovery process.*
WIDS = *Waste Information Data System.*
WMA = Waste Management Area.

1.9 CONTAMINANTS OF POTENTIAL CONCERN

Tables 1-4a, 1-4b, and 1-4c represent the master list of contaminants of potential concern (COPC) that could have been associated with the process waste pipeline systems. This unconstrained list of COPCs was developed based on process knowledge information available for facilities operations in the 200 Areas.

Table 1-4a. 200 Areas Master List of Contaminants of Potential Concern–Radionuclides. (2 Pages)

Radionuclides		
Actinium-225	Ensteinium-254	Plutonium-242
Actinium-227	Europium-152	Polonium-210
Actinium-228	Europium-154	Polonium-211
Aluminum-28	Europium-155	Polonium-212
Americium-241	Francium-221	Polonium-213
Americium-242	Francium-223	Polonium-214
Americium-242m	Gadolinium-152	Polonium-215
Americium-243	Gadolinium-153	Polonium-216
Antimony-122	Germanium-68	Polonium-218
Antimony-123	Gold-195	Potassium-40
Antimony-124	Hydrogen-3 (tritium)	Praseodymium-143
Antimony-125	Iodine-123	Praseodymium-144
Antimony-126	Iodine-125	Promethium-143
Antimony-126m	Iodine-129	Promethium-147
Barium-133	Iodine-131	Protactinium-231
Barium-135m	Iron-55	Protactinium-233
Barium-137	Iron-59	Protactinium-234
Barium-137m	Krypton-85	Radium-223
Barium-140	Lanthanum-140	Radium-224
Beryllium-10	Lead-209	Radium-226
Bismuth-210	Lead-210	Radium-228
Bismuth-213	Lead-211	Radon-219
Bismuth-214	Lead-212	Radon-220
Cadmium-109	Lead-214	Radon-222

Table 1-4a. 200 Areas Master List of Contaminants of Potential Concern–Radionuclides. (2 Pages)

Radionuclides		
Cadmium-113m	Manganese-54	Rhenium-187
Carbon-14	Molybdenum-93	Rhodium-106
Cerium-141	Neodymium-147	Ruthenium-103
Cerium-144	Neptunium-237	Ruthenium-106
Cesium-134	Neptunium-239	Samarium-147
Cesium-135	Nickel-59	Samarium-149
Cesium-137	Nickel-63	Samarium-151
Cesium-141	Niobium-93m	Selenium-75
Cesium-144	Niobium-94	Selenium-79
Chlorine-36	Niobium-95	Silver-108
Chromium-51	Niobium-96	Silver-110m
Cobalt-57	Niobium-98	Sodium-22
Cobalt-58	Palladium-107	Strontium-85
Cobalt-60	Phosphorus-32	Strontium-89
Curium-242	Plutonium-238	Strontium-90
Curium-243	Plutonium-239/240	Sulfer-35
Curium-244	Plutonium-241	Tantalum-182
Curium-245	Thorium-230	Uranium-235
Technetium-99	Thorium-231	Uranium-236
Tellurium-121	Thorium-232	Uranium-237
Tellurium-125m	Thorium-233	Uranium-238
Tellurium-127	Thorium-234	Vanadium-49
Tellurium-129	Thulium-170	Yttrium-88
Tellurium-129m	Tin-113	Yttrium-90
Thallium-204	Tin-123	Yttrium-91
Thallium-207	Tin-123m	Zinc-65
Thallium-208	Tin-125	Zirconium-93
Thallium-209	Tin-126	Zirconium-95
Thorium-227	Uranium-232	
Thorium-228	Uranium-233	
Thorium-229	Uranium-234	

Table 1-4b. 200 Areas Master List of Contaminants of Potential Concern – Inorganics. (2 Pages)

Inorganics[a]		
Aluminum	Ceric iodate	Hydroiodic acid
Aluminum nitrate (mono basic)	Ceric nitrate	Hydroxide
Aluminum nitrate (nonahydrate)	Ceric sulfate	Indium
Aluminum sulfate	Cesium	Iodine
Ammonia/ammonium	Cesium chloride	Iron
Ammonium chloride	Chloride	Kleen-O-Bowl
Ammonium fluoride	Chloroplatinic acid	Lanthanum
Ammonium hydroxide	Chromium	Lanthanum fluoride
Ammonium nitrate	Chromium (VI)	Lanthanum hydroxide
Ammonium silicofluoride	Chromium nitrate	Lanthanum nitrate
Ammonium sulfate	Chromous sulfate	Lanthanum-neodymium nitrate
Ammonium sulfite	Clayton Kerful cleaner	Lead
Antimony	Clorox	Lead nitrate
Arsenic	Cobalt	Lithium
Barium	Cobalt sulfate	Magnesium
Barium nitrate	Copper	Magnesium carbonate
Beryllium	Cyanide	Magnesium nitrate
Bismuth	Dichromate	Magnesium oxide
Boron	Ferric ammonium sulfate	Magnesium silicate (mistron)
Borate(s)	Ferric nitrate	Manganese
Boric acid	Ferric sulfate	Mercury (inorganic)
Borax (boric acid)	Ferrous ammonium sulfate	Mercuric nitrate
Bromine	Ferrous sulfamate	Mercuric thiocyanate
Cadmium	Hydrogen peroxide	Potassium acetate
Cadmium nitrate	Molybdenum	Potassium bicarbonate
Calcium	Neodymium	Potassium carbonate
Calcium carbonate	Nickel	Potassium dichromate
Calcium chloride	Nickel nitrate	Potassium ferrocyanide
Calcium Nitrate	Nickel sulfate	Potassium fluoride
Carbon	Nitrate/nitrite	Potassium hydroxide
Carbon dioxide	Nitric acid	Potassium iodate
Carbon disulfide	Nitrogen	Potassium oxalate
Carbonate (axb)	Oakite LSD	Potassium permanganate
Cerium	Osmium	Potassium persulfate
Ceric ammonium nitrate	Oxides	Rhodium
Ceric fluoride	Oxygen	Ruthenium
Ferrous sulfate	Ozone	Sani-Flush
Fluorine (as fluoride)	perchlorate	Selenium
Gallium	Periodic acid	Silicon

Table 1-4b. 200 Areas Master List of Contaminants of Potential Concern – Inorganics. (2 Pages)

Inorganics[a]		
Gallium oxide	Permanganate	Silver
Germanium	Phosphorus	Silver nitrate
Gold	Phosphate	Silver oxide
Hafnium	Phosphoric acid	Sodium
Hydrobromic acid	Phosphorous pentoxide	Sodium acetate
Hydrochloric acid	Phosphotungstic acid	Sodium bismuthate
Hydrofluoric acid	Platinum	Sodium bisulfate
Hydrogen	Plutonium	Sodium bromate
Hydrogen fluoride	Potassium	Sodium carbonate
Sodium dichromate	Strontium fluoride	Turco 4306 B, C, and D
Sodium ferrocyanide	Strontium nitrate	Turco 4502D
Sodium fluoride	Sulfamic acid	Turco 4512 A
Sodium hydroxide	Sulfate/sulfite	Uranium
Sodium nitrate	Sulfonate	Vanadium
Sodium nitrite	Sulfuric acid	Yttrium
Sodium oxalate	Tantalum	Zeolite AW-500 (IX resin)
Sodium persulfate	Tellurium	Zinc
Sodium phosphate	Tin	Zinc amalgam
Sodium sulfate	Titanium	Zirconium
Sodium thiosulfate	Titanium chloride	Zirconyl nitrate
Spic-n-Span	Tungsten	Zirconyl phosphate
Strontium		

[a] Trademarks and registered trademarks are the property of their respective owners. All product names mentioned are listed for contaminant potential only; such listing does not imply ownership and does not constitute endorsement.

IX = ion exchange.

Table 1-4c. 200 Areas Master List of Contaminants of Potential Concern – Organics. (4 Pages)

Organics[a]		
1,1-dichloroethane (DCA)	Acenaphthene	Chlorobenzene
1,1-dichloroethene	Acenaphthylene	Chlorodifluoromethane (Freon 22)
1,1-dimethylhydrazine	Acetic acid	Chloroethane
1,1,1-trichloroethane (TCA)	Acetic acid ethyl ester	Chloroform
1,1,2-trichloroethane	Acetic acid n-butyl-ester	Chloromethane
1,1,2,2-tetrachloroethane	Acetone	Chrysene
1,2-dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	Acetonitrile	Cis-1,2-dichloroethylene
1,2-dichlorobenzene	Acetophenone	Cis-1,3-dichloropropene

Table 1-4c. 200 Areas Master List of Contaminants of Potential Concern – Organics. (4 Pages)

Organics[a]		
1,2-dichloroethane (DCA)	Acrolein	Citric acid
1,2,2-trichloro-1,1,2-trifluoroethane	Acrylonitrile	Cyclohexane
1,2,4-trichlorobenzene	Aldrin	Cyclohexanone
1,3-butadiene	Alizarin yellow	Cyclohexene
1,3-dichlorobenzene	alpha-BHC	Cyclopentane
1,4-dinitrobenzene	Ammonium oxalate	DDT/DDD/DDE (total)
1,4-dioxane	Ammonium perfluorooctanoate	Decane
1-chloroethene (vinyl chloride)	AMSCO	Di-(2-ethylhexyl) phosphoric acid
1-methylpropyl alcohol (2-butanol)	Anthracene	Diacetone alcohol
2,4-dinitrophenol	Anti-Foam 60 (GE)	Dibenz[a,h]anthracene
2,4-dinitrotoluene	Arsenzao III	Dibenzofuran
2,4,5-trichlorophenol	Benzene	Dibutyl butyl phosphonate (DBBP)
2,6-bis(tert-butyl)-4-methylphenol	Benzene hexachloride	Dibutyl phosphate (DBP)
2-butanone (methyl ethyl ketone/MEK)	Benzo(a)anthracene	Dichlorodifluoromethane
2-butenaldehyde (2-butenal)	Benzo(a)pyrene	Dichlorofluoromethane (Freon 21)
2-heptanone	Benzo(b)fluoranthene	Dichloromethane (methylene chloride)
2-hexanone	Benzo(ghi)perylene	Dieldrin
2-methyl-2-propanol	Benzo(k)fluoranthene	Diethylphthalate
2-methyl-2-propenenitrile	Benzyl alcohol	Di-n-butylphthalate
2-methylphenol (o-cresol)	beta-BHC [Lindane]	Diversy Chemical 159
2-pentanone	Biphenyl	Dodecane
2-propenoic acid	Bromocresol purple	Dow Anti-Foam B
2-sec-butyl-4,6-dinitrophenol (dinoseb)	Bromomethane	Dowex 21 K/Amberlite XE-270 (IX resin)
3-chloropropene	Bromonaphthalene	Duolite ARC-359 (IX resin)
3-heptanone	Butane	Endrin
3-methyl-2-butanone	Butanol	Ethanol
3-pentanone	Butylated hydroxy toluene	Ethyl benzene
4-heptanone	Carbazole	Ethyl ether
4-methylphenol (p-cresol)	Carbon tetrachloride	Ethylene dibromide
5-methyl-2-hexanone	Chlordane	Ethylene glycol
Ethylene-diamine tetraacetic acid (EDTA)	Monobutyl phosphate (MBP)	Pyridine
Fluoranthene	m-xylene	Saf-Tee Solvent F.O. 128
Formaldehyde	Naphthalene	s-diphenyl carbazide
Formic acid	Naphthylamine	Shell E-2342
gamma-BHC (Lindane)	n-butyl benzene	Shell spray base
Glycerol	n-heptane	Sodium gluconate
Greases	n-hexane	Sodium tartrate

Table 1-4c. 200 Areas Master List of Contaminants of Potential Concern – Organics. (4 Pages)

Organics[a]		
Heptachlor	Nitrilotriacetic acid (NTA)	Soltrol-170
Hexachlorobenzene	Nitrobenzene	Spartan DC 13
Hexachlorobutadiene	n,n-diphenylamine	Sugar
Hexachloroethane	n-nitroso-n,n-dimethylamine	Sulfonic acid (chloro)
Hexachloronaphthalene	n-nonane	Super Gel Hyflo
Hexafluoroacetone	n-octane	Tartaric acid
Hexanal	Normal paraffin hydrocarbons	Tetrabromoethane
Hydrazine	n-pentane	Tetrachloroethylene (PCE)
Hydroxyacetic acid	n-propionaldehyde	Tetrachloronaphthalene
Hydroxylamine hydrochloride	n-propyl alcohol (1-propanol)	Tetradecane
Hydroxylamine nitrate (HN)	Oakite clear guard	Tetrahydrofuran
Hydroxyquinoline	Oakite rust stripper	Tetraphenyl boron
Hyflo-Super-Cel	Oakite Swiff	Thenyltrifluoroacetone
Immunol 1468-2	Octachloronaphthalene	Thymolphthalein
Indeno[1,2,3-cd]pyrene	o-phenanthroline	Tide
Ionac A-580/Permutit [SKA] (IX resin)	Orvus K	Toluene
Isodrin	Oxalic acid	Total organic carbon
Isopropyl alcohol	Peroklean	Turco (Fabricfilm)
Jasco paint stripper	Phenanthrene	Turco 2822
Kelite 25E	Phenol	Turco 4358-4A
Keraff	Phosphotungstic acid (PTA)	Turco 4501 A
Kerosene	Picric acid	Turco 4518
Lard oil	p-nitrochlorobenzene	Turco 4521
Mandelic acid	Polychlorinated biphenyls (PCB)	Turco 4605-8
Methanol	Propionitrile	Turco 4669
Methyl isobutyl ketone (MIBK/hexone)	p-xylene	Turco 4715
Methyl isocyanate	Total petroleum hydrocarbons (TPH)	Turco 4738 (thin)
Methyl lactic acid	Toxaphene	Pyrene
Methylcyclohexane	Trans-1,2-dichloroethene	Turco alkaline (rust remover)
Methylhydrazine	Trans-1,3-dichloropropene	Turco Diesel Zit 2
Mineral oil	Tributyl phosphate (TBP)	Turco EPO Strip
Molybdate - citrate reagent	Trichloroethylene (TCE)	Turco EPO Strip NP
Mono-2-ethylhexyl phosphoric acid	Trichlorofluoromethane	Turco Plaudit
Oxirane (ethylene oxide)	Triethylamine	Turco T-5561
o-xylene	Tri-iso-octylamine	Turco T-5589
Pace-S-Teen	Tri-n-dodecylamine	Turco 2844
Pentachloronaphthalene	Tri-n-octylamine	Urea

Table 1-4c. 200 Areas Master List of Contaminants of Potential Concern – Organics. (4 Pages)

Organics[a]		
Pentachlorophenol	Tris (hydroxymethyl) amino methane	West Lode degreaser
Pentasodium diethylene triamine penta acetate (DTPA)	Trisodium hydroxyethyl ethylene-diamine triacetate (HEDTA)	Wyandotte 1112
Penvert 192	Trisodium nitrilo triacetate (NTA)	Wyandotte Kevlar
Wyandotte MF	Wyandotte P1075	Xylene

[a] Trademarks and registered trademarks are the property of their respective owners. All product names mentioned are listed for contaminant potential only; such listing does not imply ownership and does not constitute endorsement.
IX ion exchange.

Liquid process waste streams carried through the pipeline systems required disposition decisions that involved either transfer to tanks within WMAs or disposal from facilities operations to cribs, trenches or other liquid waste disposal sites. These waste transfer and disposal decisions were based on waste composition. Because of known differences in process waste stream characteristics, separate discussions are presented to address COPC and analytical reporting requirements for pipeline systems associated with waste streams transferred from facilities directly to liquid disposal waste sites and those process wastes sent to/transferred between or transferred out of tank farms. Refinement of the unconstrained COPCs presented in the tables above, based on this differentiation, is presented in the following sections.

1.9.1 Refinement of the Contaminants of Potential Concern List for Facilities Process Waste Pipeline Systems

Process waste generated in the facilities within the Central Plateau 200 Areas and transferred directly to liquid-waste disposal sites has been the focus of the numerous characterization investigations conducted to date. A DQO process was conducted in conjunction with each of these waste site investigations to prepare final COPC lists. For development of the 200-UR-1 OU DQO, all previous DQO COPC lists where compiled, reviewed, and refined into one comprehensive list. This comprehensive list of COPC is presented in Table 1-5. The list encompasses all COPCs that would be considered as primary target constituents for laboratory analysis associated with the facilities process waste pipeline systems. Several additional analytes have been included at the request of Ecology. Rationale for exclusion of certain of analytes, based on process knowledge, existing liquid-waste disposal-site sampling results, or other reasons, in conjunction with sampling and analytical requirements for specific process waste pipeline systems, is presented in Section 1.9.3.

Table 1-5. Facilities Process Waste Pipeline Systems Contaminants of Potential Concern. (2 Pages)

Radioactive Constituents	
Americium-241	Niobium-94 [a]
Carbon-14	Plutonium-238
Cesium-137	Plutonium-239/240
Cobalt-60	Strontium-90
Europium-152	Technetium-99
Europium-154	Tritium
Europium-155	Uranium-233/234
Neptunium-237	Uranium-235/236
Nickel-63	Uranium-238
Chemical Constituents – Metals	
Antimony	Lead
Arsenic	Mercury
Barium	Nickel
Beryllium	Selenium
Cadmium	Silver
Chromium	Uranium
Hexavalent Chromium	Vanadium
Copper	Zinc
Chemical Constituents – Other Inorganics	
Cyanide	Nitrate/Nitrite
Fluoride	Sulfate
Chemical Constituents – Volatile Organics	
Acetone	Halogenated hydrocarbons
Acetonitrile	Hexane
Benzene	Methyl ethyl ketone
n-Butyl benzene	Methyl isobutyl ketone (MIBK)
1-Butanol (n-butyl alcohol)	Perchloroethylene
2-Butanone (MEK)	Tetrahydrofuran
Carbon Tetrachloride	Toluene
Chlorobenzene	1,1,1 Trichloroethane (TCA)
Cis-1,2-dichloroethylene	1,1,2 Trichloroethane
Cyclohexane	Trans-1,2-dichlorotheylene
1,1-dichloroethane	Tetrachloroethylene (PCE)
1,2-dichloroethane	Trichloroethylene (TCE)
1,1-dichloroethylene	Vinyl chloride
Dichloromethane (Methylene Chloride)	Xylene
Ethylbenzene	

Table 1-5. Facilities Process Waste Pipeline Systems Contaminants of Potential Concern. (2 Pages)

Chemical Constituents – Semivolatile Organics[d]	
AMSCO [b] Tributyl phosphate dilutant	Normal paraffin hydrocarbon
Cyclohexanone	Polyaromatic Hydrocarbons
Diesel fuel [c]	Paint thinner
Dodecane	Phenol
Hydraulic Fluids (greases)	Polychlorinated biphenyls
Kerosene	Shell E-2342 (naphthalene and paraffin)
Naphthylamine	Soltrol-170 ($C_{10}H_{22}$ to C_6 to H_{34}; purified kerosene)
Dibutylphosphate*	Tributyl phosphate and derivatives (mono, bi)
Monobutylphosphate*	Formate*
Oxalate*	Glycolate*

*Added to list as requested by Ecology (chelators or extractants used in processes).
[a] Contaminant of potential concern applicable to Plutonium Finishing Plant Area only.
[b] Allen Maintenance Supply Company Inc.
[c] Analyzed as total petroleum hydrocarbons-diesel range; other total petroleum hydrocarbon analyses will include gasoline range.
[d] Trademarks and registered trademarks are the property of their respective owners. All product names mentioned are listed for contaminant potential only; such listing does not imply ownership and does not constitute endorsement.

1.9.2 Refinement of Contaminants of Potential Concern List for Tank Farms Process Waste Pipeline Systems

A separate DQO process has been completed to address determination of the COPC list for residual process waste remaining in the SST tank farms following waste retrieval (RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*). The SST DQO was undertaken to ensure that appropriate data would be collected to support the component closure activities for all SSTs and to cover all sampling and analytical activities for that purpose. The SST DQO did not address soil sampling and analysis or any actions associated with ancillary equipment. The strategy used in the SST DQO for identification of COPCs and determination of analytical requirements has been incorporated into this DQO process for application to the process waste pipeline systems associated with the tank farms. This strategy identifies specific or "primary" constituents (03-ED-009, 2003, "Hanford Facility Dangerous Waste Part A Permit Application Form 3, Revision 8, for the Single-Shell Tank (SST) System," Attachment: *Hanford Facility Dangerous Waste Part A Permit Application Form 3, Revision 8 for the Single-Shell Tank System*; underlying hazardous constituents, and radionuclides from 10 CFR 61.55, "Licensing Requirements for Land Disposal of Radioactive Waste," "Waste Classification,") for analyses performed by selected analytical methods. Development of this primary constituent list is correlative in purpose and use to the COPC list that was prepared for the facilities process waste pipeline systems. The SST DQO also includes a strategy for reporting of secondary constituents. Laboratory analytical performance requirements for primary constituents are presented in Step 3 of this DQO. Primary radionuclide, inorganic, and organic constituents identified for the tank farm process waste pipeline systems are presented in Table 1-6.

Table 1-6. Tank Farms Process Waste Pipeline Systems Constituents list. (2 Pages)

Radioactive Constituents	
Antimony-125	Nickel-63
Americium-241	Plutonium-238
Carbon-14	Plutonium-239/240
Cesium-137	Plutonium-241
Cobalt-60	Selenium-79
Curium-242	Strontium-90
Curium-243	Technetium-99
Curium-244	Thorium-228
Europium-152	Thorium-230
Europium-154	Thorium-232
Europium-155	Tritium
Neptunium-237	Uranium-233/234
Nickel-63	Uranium-235/236
Iodine-129	Uranium-238
Neptunium-237	
Chemical Constituents – Metals	
Aluminum	Lead
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Selenium
Cadmium	Silver
Chromium III/ Chromium (total)	Strontium
Cobalt	Thallium
Copper	Uranium
Hexavalent Chromium	Vanadium
Iron	Zinc
Chemical Constituents – Other Inorganics	
Cyanide (includes ferrocyanide)	Nitrogen in nitrate/nitrite
Fluoride	Sulfide
Nitrate	Ammonia (NH_3)
Nitrite	Ammonium (NH_4)
Chemical Constituents – Volatile Organics	
Acetone	1,1,1-Trichloroethane (TCA)
Benzene	1,1,2-Trichloroethane
Carbon disulfide	Tetrachloroethane; 1,1,2,2-
Carbon tetrachloride	Tetrachloroethene; 1,1,2,2- (PCE)
Chlorobenzene	Toluene

Table 1-6. Tank Farms Process Waste Pipeline Systems Constituents list. (2 Pages)

Chloroform (trichloromethane)	trichloro-1,2,2-trifluoroethane; 1,1,2-
1,2-Dichloroethane	Butanol; n- (n-butyl alcohol)
1,1-Dichloroethylene	Isobutyl alcohol (Isobutanol)
Dichloromethane (methylene chloride)	methylphenol; 2,6-Bis(tert-butyl)-4-
Dichloropropene; 1,3,- (trans-)	Trichloroethylene (TCE)
Ethyl acetate	Trichlorofluoromethane
Ethyl ether	Vinyl chloride
Ethyl benzene	Xylenes
Methyl isobutyl ketone (MIBK hexone)	Xylene; m-
Methyl ethyl ketone (MEK)	Xylene; o-
Nitropropane; 2-	Xylene; p-
Chemical Constituents – Semivolatile Organics	
Acrylic acid*	n-nitrosomethyl amine*
Acetonitrile*	n-nitrosomethylethyl amine*
Cyclohexanone	Trimethylamine*
Hexachloroethane	Nitrobenzene
Acenaphthene	Nitrophenol; o-
Bis-2-ethylhexyl phthalate (Dioctylphthalate)	Nitroso-di-n-propylamine; N-
Butylbenzylphthalate	1,2,4 - Trichlorobenzene
Butadiene;1,3-*	Nitrosomorpholine; N-
Chlorophenol; 2-	Pyrene
Cresol; m + p (3- and 4-Methylphenol)	Pyridine
Cresol; o- (2-Methylphenol)	Trichlorophenol; 2,4,5-
Cresylic acid (cresol, mixed isomers)	Trichlorophenol; 2,4,6-
Dibutylphthalate (Di-n-butylphthalate)	Tributyl phosphate
Di-n-octylphthalate	Aroclor 1016 [a]
Dichlorobenzene; 1,2- (ortho-)	Aroclor 1221
Dinitrotoluene; 2,4-	Aroclor 1232
Ethoxyethanol; 2-	Aroclor 1242
Fluoranthene	Aroclor 1248
Hexachlorobutadiene	Aroclor 1254
methylphenol; 4-Chloro-3- (p-Chloro-m-cresol)	Aroclor 1260
Naphthalene	

*Additional analyte added as requested by Ecology (constituent detected in tank vapor samples).

[a] Aroclor is an expired trademark.

1.9.3 Contaminants of Potential Concern Exclusion Process

Constituents presented in Tables 1-5 and 1-6 represent a comprehensive listing of the primary analytes that may be associated with some process waste pipeline systems. Not all of these constituents are assumed to occur in every waste stream handled by the pipeline systems. Process knowledge and analytical data gathered through the sampling and analysis at liquid waste disposal sites and tanks will be used as appropriate to support the exclusion rational. Supporting information and additional discussion pertaining to the exclusion process, if used, will be presented in the 200-IS-1 OU Work Plan (DOE/RL-2002-14).

This DQO process has elected to use general "suite type" analytical techniques, which yield results on many metals and organic compounds, providing a cost-effective approach for detecting waste constituents. A summary of the exclusion rational appears below. COPCs in the following categories were excluded from further consideration:

- Short-lived radionuclides
- Radionuclides that constitute less than 1 percent of the fission product inventory, and for which historical sampling indicates non-detection
- Naturally occurring isotopes that were not created as a result of Hanford Site operations
- Constituents with atomic mass numbers greater than 242 that represent less than 1 percent of the actinide activities
- Progeny (P) radionuclides that yield insignificant activities within 50 years, and/or for which parent/progeny relationships exist that permit progeny estimation
- Chemicals that have no known carcinogenic or toxic effects
- Constituents that have been diluted, neutralized, and/or decomposed by high volumes of water discharged and/or the presence of acids and bases
- Chemicals that are unlikely to be present in toxic or high concentrations because of significant dilution during cooling-water discharges
- Chemicals that are not persistent in the environment.

Initial analyte lists will be compared to RI characterization data as a means of focusing on reducing the analytes list.

1.10 POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND PRELIMINARY REMEDIATION GOALS

Potential ARARs identified for the remedial actions within the 200 Areas are presented in the Implementation Plan (DOE/RL-98-28). ARARs associated with potential alternative actions will be further refined in the FS.

Table 1-7 defines the preliminary ARARs identified for the 200-IS-1 OU DQO process.

Table 1-7. List of Preliminary Applicable or Relevant and Appropriate Requirements and Action Levels. (5 Pages)

Contaminants of Potential Concern	Area within the Hanford Site	Depth Inteval for Compliance	Preliminary ARARs	ARAR Requirement/ Rationale	Radiological Effective Dose	Method Used to Determine Concentra-tions	Action Levels
Radiological Constituents	Inside the Central Plateau Land-Use Boundary [a]	Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)		Radiation Protection of the public and environment in the vicinity of DOE facilities	100 mrem/yr above background via industrial land-use scenario while under DOE control	RESRAD modeling. [b] (industrial exposure scenario)	Contaminant-specific
		Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)	OSWER 9200.4-18 (TBC)	OSWER 9200.4-18 provides guidance on cleanup levels at CERCLA sites. The EPA has determined in this directive that dose limits established by the NRC in 40 CFR 196 (25 mrem/yr) generally are not protective at CERCLA sites and instead states that a cleanup level of 15 mrem/yr is protective of human health and the environment. The EPA dose limits are to generally achieve risk levels in the 10^{-4} to 10^{-6} risk range	15 mrem/yr above background at the end of the exclusive-use period	RESRAD modeling. [b] (industrial exposure scenario)	Contaminant-specific
		Vadose zone (ground surface to groundwater table)	MCLs, state, and Federal ambient water quality control criteria (40 CFR 141.66)	Annual dose limit equivalent for protection of groundwater	4 mrem/yr above background to groundwater (equivalent dose), or no additional groundwater degradation [c]	Alternatively, approved site-specific modeling	Contaminant-specific

Table 1-7. List of Preliminary Applicable or Relevant and Appropriate Requirements and Action Levels. (5 Pages)

Contaminants of Potential Concern	Area within the Hanford Site	Depth Inteval for Compliance	Preliminary ARARs	ARAR Requirement/ Rationale	Radiological Effective Dose	Method Used to Determine Concentra-tions	Action Levels
Radiological Constituents (continued)	Outside the Central Plateau land-use boundary	Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)	OSWER 9200.4-18 (TBC)	OSWER 9200.4-18 provides guidance on cleanup levels at CERCLA sites. The EPA has determined in this directive that dose limits established by the NRC in 40 CFR 196 (25 mrem/yr) generally are not protective at CERCLA sites and instead states that a cleanup level of 15 mrem/yr is protective of human health and the environment. The EPA dose limits are to generally achieve risk levels in the 10^{-4} to 10^{-6} risk range.	15 mrem/yr above background	RESRAD modeling [b] (residential exposure scenario)	Contaminant-specific
		Vadose zone (ground surface to groundwater table)	MCLs, state, and Federal ambient water quality control criteria (40 CFR 141.66)	Establishes MCLs that are drinking-water criteria designed to protect human health from the potential adverse effects of radionuclides in drinking water	4 mrem/yr above background to groundwater, or no additional groundwater degradation [c]	Alternatively, approved site-specific modeling	Contaminant-specific
	Inside and Outside the Central Plateau Land-Use Boundary	Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)	Terrestrial wildlife BCG [d]	Identifies ecological indicator soil concentrations for protection of terrestrial plants and animals. [e]	Contaminant-specific	RESRAD-BIOTA [f]	Contaminant-specific
Nonradiological Constituents	Inside the Central Plateau Land-Use Boundary	Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)	"Soil Cleanup Standards for Industrial Properties" WAC 173-340-745(5)(b)(iii)	Identifies the methods used to identify risk-based concentrations and their use in the selection of a cleanup action. Cleanup and remediation levels are based on protection of human health and the environment, the location of the site, and other regulations that apply to the site. The standard specifies cleanup goals that implement the strictest Federal or state cleanup criteria.	Not applicable	Method C	Contaminant-specific

Table 1-7. List of Preliminary Applicable or Relevant and Appropriate Requirements and Action Levels. (5 Pages)

Contaminants of Potential Concern	Area within the Hanford Site	Depth Inteval for Compliance	Preliminary ARARs	ARAR Requirement/ Rationale	Radiological Effective Dose	Method Used to Determine Concentra-tions	Action Levels
Nonradiological Constituents (cont)	Outside the Central Plateau Land-Use Boundary	Shallow zone (0 to 4.6 m [0 to 15 ft] bgs)	"Unrestricted land use soil cleanup standards" WAC 173-340-740(3)(b)	Identifies the methods used to identify risk-based concentrations and their use in the selection of a cleanup action. Cleanup and remediation levels are based on protection of human health and the environment, the location of the site, and other regulations that apply to the site. The standard specifies cleanup goals that implement the strictest Federal or state cleanup criteria.	Not applicable	Method B	Contaminant-specific
	Inside and Outside the Central Plateau Land-Use Boundary	Shallow zone (0 to 4.6 m [0 to 15 ft] bgs?)	WAC 173-340-7493, WAC 173-340-900, Table 749-3	Identifies ecological indicator soil concentrations for protection of terrestrial plants and animals. [e]	Not applicable	Methods to be used for developing wildlife indicator concentrations are described in Tables 749-4 and 749-5 (WAC 173-340-900).	Contaminant-specific
		Vadose zone (ground surface to groundwater table)	WAC 173-340-747(4)	Groundwater in the 200 Areas is not used currently for drinking water, but it could be used in the future if the site were released from institutional controls. In addition, groundwater in the 200 Areas is connected hydraulically to groundwater that is used for drinking water and to the Columbia River. Remedial alternatives need to ensure that migration of waste site contaminants to groundwater does not cause the groundwater to exceed MCLs and non-zero MCLGs pursuant to State requirements contained in WAC 173-340-720.	Not applicable	Fixed parameter three-phase partitioning model (Equation 747-1) (Method B); alternatively, approved site-specific modeling.	Contaminant-specific

Table 1-7. List of Preliminary Applicable or Relevant and Appropriate Requirements and Action Levels. (5 Pages)

Contaminants of Potential Concern	Area within the Hanford Site	Depth Inteval for Compliance	Preliminary ARARs	ARAR Requirement/ Rationale	Radiological Effective Dose	Method Used to Determine Concentra-tions	Action Levels
Special Radiological Waste Constituents							
TRU Waste Constituents	Inside and Outside the Central Plateau Land-Use Boundary	Vadose zone (ground surface to groundwater table)	40 CFR 191.12	Radioactive waste containing more than 100 nCi of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years except for (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the EPA, does not need the degree of isolation required by the 40 CFR 191 disposal regulations; or (3) waste that the NRC has approved on a case-by-case basis in accordance with 10 CFR 61. [g]	Not dose specific	Not defined in WAC 173-340; use analytical results.	Containing more than 100 nCi of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years.
Greater Than Class C Waste Constituents		Vadose zone (ground surface to groundwater table)	Radioactive waste containing concentrations in excess of 10 CFR 61.55 levels.	Defines waste designation and waste management requirements.	Not dose specific	Not defined in WAC 173-340; use analytical results.	Contaminant-specific
Dangerous Waste		Equipment No specific depth designated for equipment (closure)	WAC 173-303-610(2), WAC-173-303-070	Defines how to determine which materials are subject to the designation regulations.	N/A	WAC 173-303-610(2)(b)(ii)	Contaminant-specific
		Vadose Zone Soil (closure)	WAC 173-303-610(2)	Defines if the site can be clean closed or closed as a landfill (placement of a barrier)	N/A	WAC 173-303-610(2)	Contaminant-specific

[a] Based on DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*.
[b] The RESidual RADioactivity dose model (RESRAD) has been used for similar waste sites and will be used as a minimum for direct exposure. If models that are more appropriate are developed, they will be evaluated for use (ANL, 2002, *RESRAD for Windows*, Version 6.21).
[c] Radionuclide standards are not final and will be agreed upon in the record of decision.
[d] DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, Table 6.4 of Module 1.
[e] A phased baseline ecological evaluation is planned for the 200 Areas. This evaluation will supplement other characterization data for waste sites in the Central Plateau. The evaluation will provide information that may support evaluation of the health and/or condition of the ecosystem across habitats.

Table 1-7. List of Preliminary Applicable or Relevant and Appropriate Requirements and Action Levels. (5 Pages)

Contaminants of Potential Concern	Area within the Hanford Site	Depth Inteval for Compliance	Preliminary ARARs	ARAR Requirement/ Rationale	Radiological Effective Dose	Method Used to Determine Concentra-tions	Action Levels

[f] ANL, 2006, *RESRAD-BIOTA*, Version 1.2.

[g] Radioactive waste containing more than 100 nCi/g (3700 Bq/g) of alpha-emitting transuranic isotopes with half-lives greater than 20 years, other than the exceptions noted in DOE G 435.1-1, Chapter 3, "Transuranic Waste Requirements."

10 CFR 61.55, "Licensing Requirements for Land Disposal of Radioactive Waste," "Waste Classification."
10 CFR 834, "Radiation Protection of the Public and the Environment," proposed rule.
40 CFR 141.66, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels for Radionuclides."
40 CFR 191.12, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," "Definitions."
40 CFR 196, "Radiation Site Cleanup Standards."

EPA, 1997, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, OSWER Directive 9200.4-18.
WAC 173-303, "Dangerous Waste Regulations."
WAC 173-303-070, "Designation of Dangerous Waste."
WAC 173-303-610(2), "Closure and Post-Closure," "Closure Performance Standard."
WAC 173-340, "Model Toxics Control Act – Cleanup."
WAC 173-340-720, "Ground Water Cleanup Standards."
WAC 173-340-740(3)(b), "Unrestricted Land Use Soil Cleanup Standards," "Method B Soil Cleanup Levels for Unrestricted Land Use," "Standard Method B Soil Cleanup Levels."
WAC 173-340-745(5)(b), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels," "Standard Method C Industrial Soil Cleanup Levels."
WAC 173-340-747(4), "Deriving Soil Concentrations for Ground Water Protection," "Fixed Parameter Three-Phase Partitioning Model."
WAC 173-340-900, "Tables."
WAC-173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures."

ARAR = applicable or relevant and appropriate requirement.
BCG = biota concentration guideline (DOE-STD-1153-2002).
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980.*
DOE = U.S. Department of Energy.
EPA = U.S. Environmental Protection Agency.
MCL = maximum contamination level.
MCLG = maximum contamination level goal.
N/A = not applicable.
NRC = U.S. Nuclear Regulatory Commission.
TBC = to be considered.

1.11 REGULATORY AND PROJECT DRIVERS

Table 1-8 provides the regulatory milestones and regulatory drivers associated with this project.

Table 1-8. Regulatory Milestones.

Milestone [a]	Due Date	Regulatory Driver
M-15-00C	December 31, 2008	"Complete all 200 Area non-Tank Farm OUs pre-ROD site investigations under approved work plan schedules."

[a] Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order.*
OU = operable unit.
ROD = record of decision.

1.12 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The current and future land use of a site must be considered to identify appropriate cleanup objectives; these uses are discussed in the following sections.

1.12.1 Current Land Use

All current land-use activities associated with the 200 Areas and the Central Plateau are industrial in nature. The facilities located in the Central Plateau were built to process irradiated fuel from the plutonium production reactors in the 100 Areas. Most of the facilities directly associated with fuel reprocessing are now inactive and awaiting final disposition. The PFP has encapsulated plutonium and currently is storing it. Several waste management facilities operate in the 200 Areas, including permanent waste disposal facilities such as the Environmental Restoration Disposal Facility, Low-Level (radioactive waste) Burial Grounds, and a RCRA-permitted, mixed-waste trench. Construction of tank waste treatment facilities in the 200 Areas began in 2002, and the 200 East Area is the planned disposal location for the vitrified low-activity tank wastes. Other Federal agencies, such as the U.S. Department of the Navy, use the Hanford Site 200 East Area for disposal into TSD units. In addition, a commercial low-level radioactive waste disposal facility currently is operated by US Ecology, Inc., on a 100-acre tract of land at the southeast corner of the 200 East Area that is leased to the State of Washington.

1.12.2 Anticipated Future Land Use

The reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future.

1.12.3 Current Groundwater/Surface Water Uses

Groundwater in the 200 Areas currently is contaminated and is not withdrawn for beneficial uses.

The Columbia River is the second largest river in the contiguous United States in terms of total flow and is the dominant surface-water body on the Hanford Site. The Columbia River is the principal source of drinking water for the Tri-Cities and the Hanford Site. Regionally, it also is used extensively for irrigation and for recreation, which includes fishing, hunting, boating, water skiing, diving, and swimming.

1.12.4 Potential Future Groundwater/Surface Water Uses

Washington State cleanup regulations define groundwater as a "potential future source of drinking water" based on yield, natural quality, and pumpability (WAC 173-340-720[2], "Ground Water Cleanup Standards," "Potable Ground Water Defined"). Based on these technical standards, groundwater underlying the 200 Areas may be considered a potential future drinking water source. In addition, groundwater underlying the 200 Areas is hydraulically connected to groundwater systems that currently are used for drinking water and irrigation, and it ultimately discharges to the Columbia River. In accordance with 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," the goal is to restore the groundwater at the Hanford Site to maximum beneficial uses, if practicable. The groundwater protection Remedial Action Objective for the 200-IS-1 OU will be based on the WAC 173-340-720, "Ground Water Cleanup Standards," and 40 CFR 141, "National Primary Drinking Water Regulations." Given the local hydrogeology at the 200-IS-1 OU, protection of the groundwater from the contaminants, by design, also will result in protection of the Columbia River. It is anticipated that current uses of the Columbia River will continue in the future.

1.13 CONCEPTUAL MODEL

A primary goal of the DQO process is to develop a sampling design that will either confirm or reject the preliminary conceptual contaminant distribution model. The preliminary conceptual contaminant distribution model is supported by the conceptual exposure pathway model.

The source of contamination in the 200-IS-1 OU is the liquid transferred through, residing in, or released from the process waste pipeline systems. The release mechanism is subsurface liquid discharge. Ingestion and inhalation of surface or subsurface soils in an occupational scenario do not represent a substantial exposure because of the waste site cover and surface stabilization. There is limited soil ingestion and inhalation in an industrial setting. Downward migration of mobile constituents into the groundwater would not affect occupational workers, because their drinking water source would not be the underlying aquifers. Similarly, contamination below 4.6 m (15 ft) would not affect an occupational worker or the flora or fauna. However, the protection of groundwater is a requirement that must be addressed by evaluating potential future impacts.

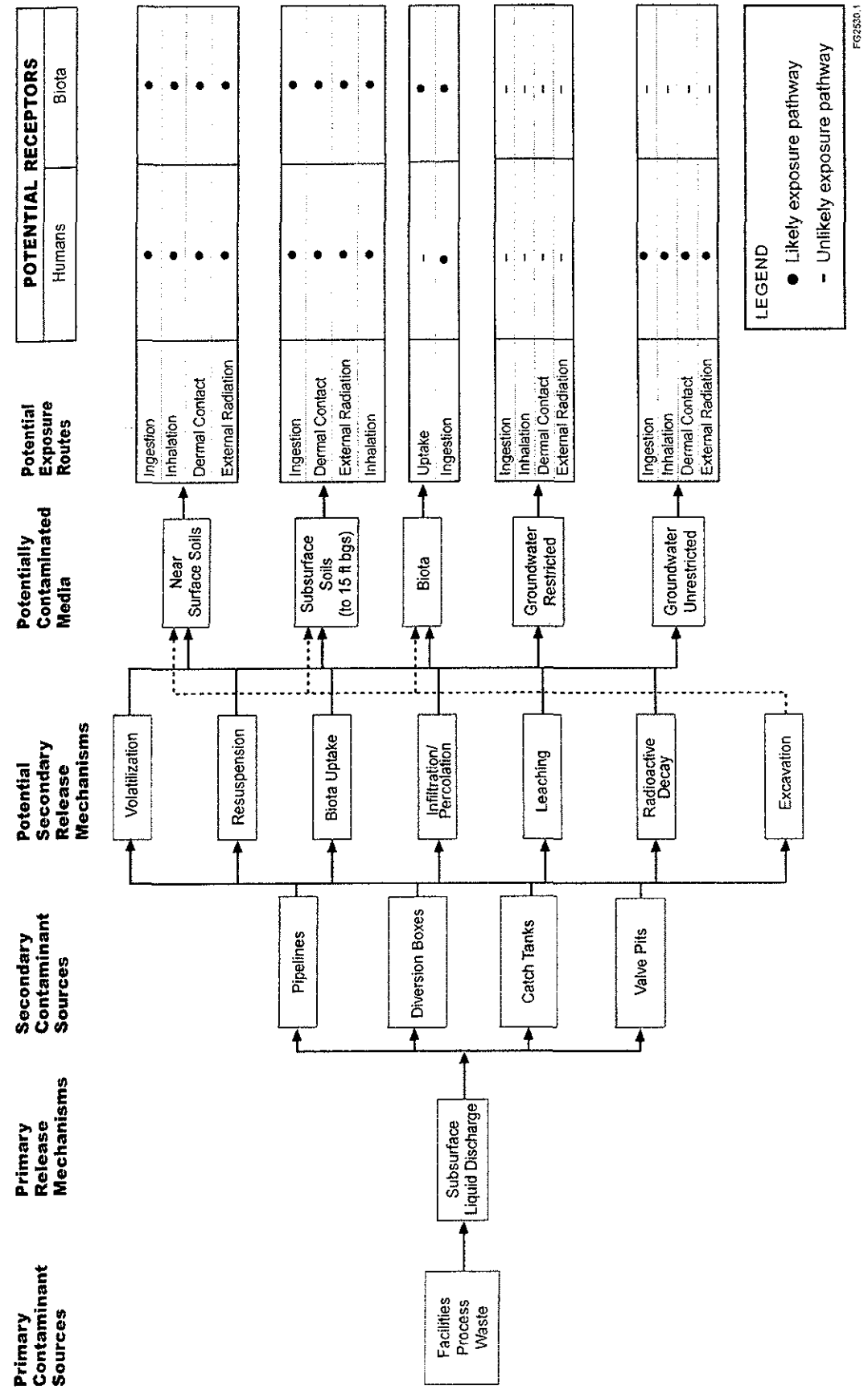
The conceptual site exposure model, identifying the sources, release mechanisms, migration pathways, and potential receptors for each of the COPCs, is shown in Table 1-9 and Figure 1-2. Table 1-9 also summarizes the potential exposure scenarios.

Table 1-9. Tabular Depiction of the Conceptual Exposure Pathway Model.

Medium	Contaminants of Potential Concern	Source	Primary Release Mechanism	Secondary Release Mechanism	Potential Exposure Pathway	Potential Receptors
Shallow vadose zone soils (<15 ft bgs)	Radionuclides, metals, volatile organic compounds, semivolatile organic compounds	200-IS-1 Operable Unit process waste pipeline systems	Subsurface liquid discharge	Secondary source from resuspension and deposition from wind-blown soil or vegetation.	Ingestion; dermal contact; inhalation; external radiation	Humans
					Ingestion, dermal contact, inhalation; external radiation; root uptake	Biota
Deep vadose zone soil and groundwater				Infiltration and Leaching	Groundwater ingestion (outside exclusive land-use area only); dermal contact; inhalation; external radiation	Humans

bgs = below ground surface.

Figure 1-2. Conceptual Exposure Pathway Model.



Figures 1-3 and 1-4 show generalized cross-sectional views of a direct buried single pipeline and buried encased multiple pipelines. Figures 1-5 and 1-67 graphically present the preliminary conceptual contaminant distribution models for the 200-IS-1 OU process waste pipeline systems.

The preliminary conceptual contaminant distribution model will become the conceptual contaminant distribution model after acceptance of this DQO summary report and then will be applied to the 200-IS-1 OU work plan (DOE/RL-2002-14).

Figure 1-3. Generalized Cross-Sectional View of a Direct-Buried Single Pipeline.

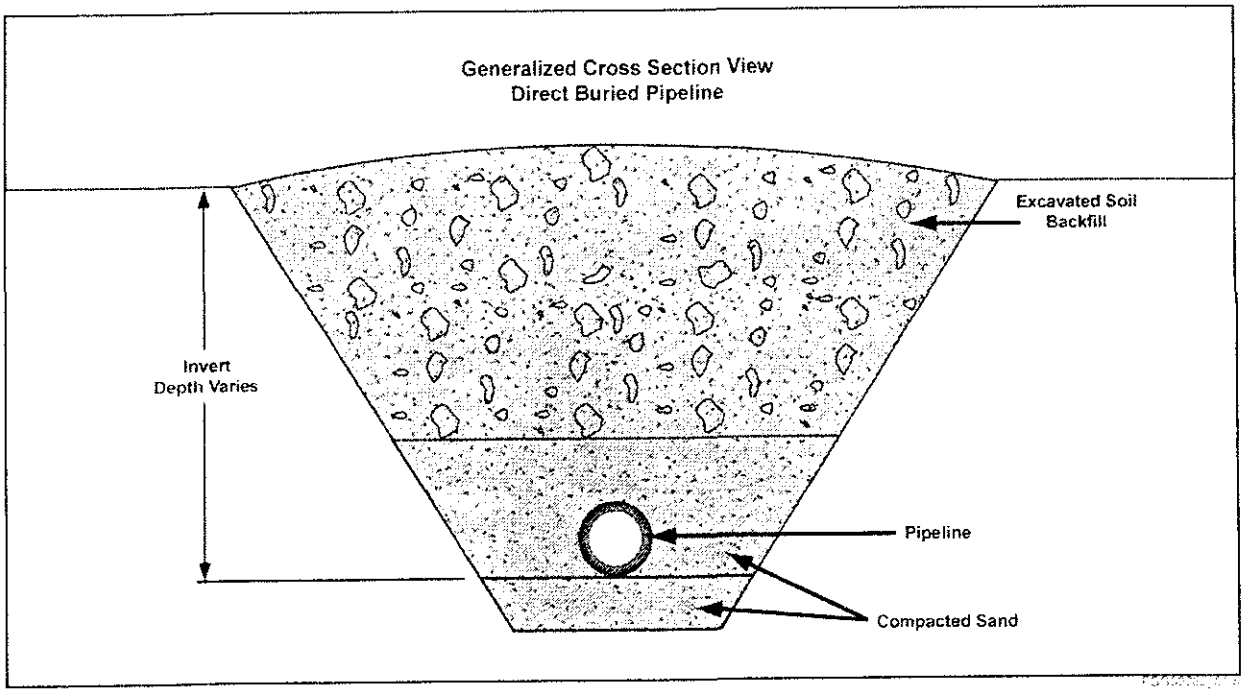


Figure 1-4. Generalized Cross-Sectional View of Buried Encased Multiple Pipelines.

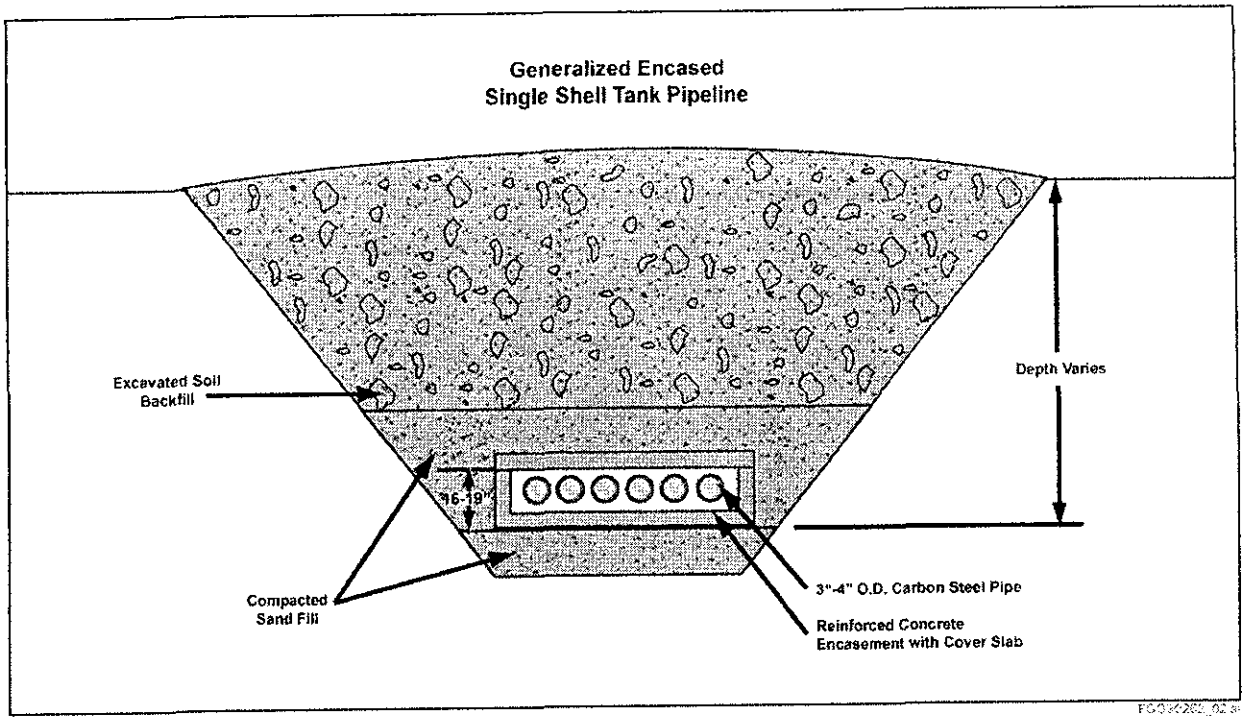
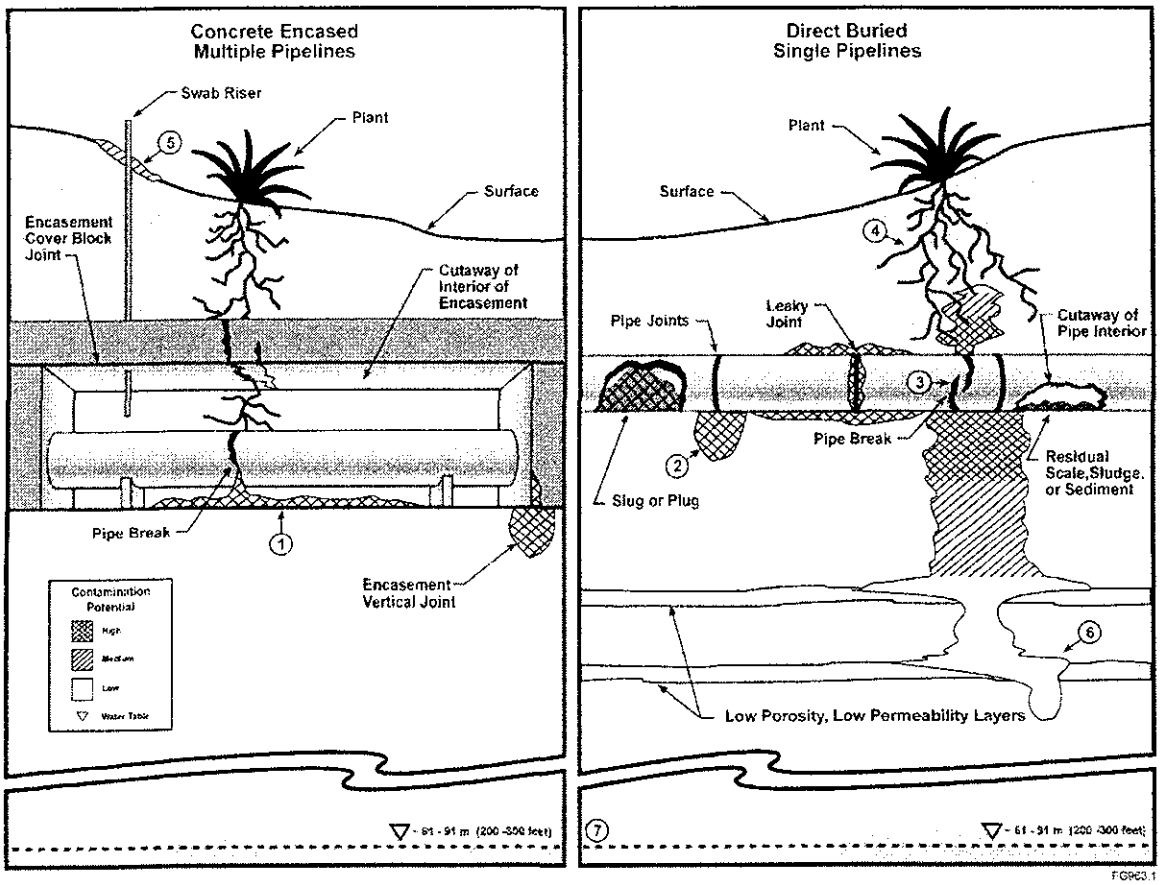
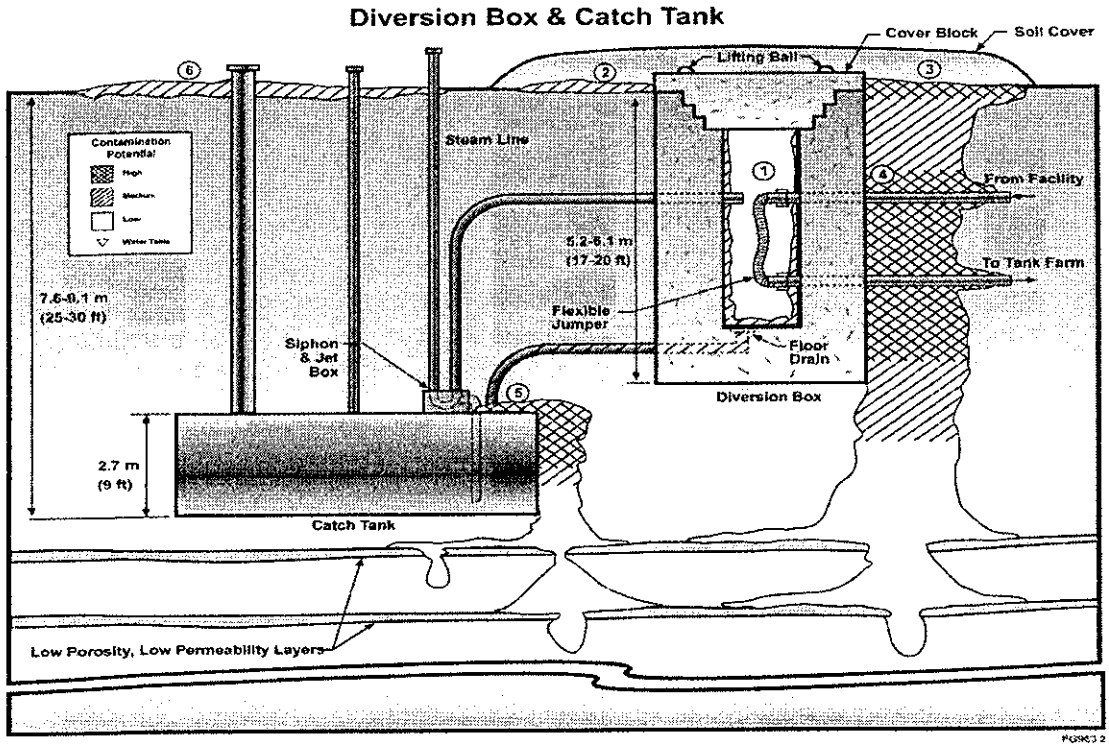


Figure 1-5. Preliminary Conceptual Contaminant Distribution Model for Buried Process Waste Pipelines.



1. Pipeline leaks have occurred within some concrete encasements. Process liquids that are released may accumulate and pool in the bottom of the encasement.
2. Pipe connection locations such as joints and fittings are susceptible to leakage. The releases are characterized as low-volume leaks and most likely are attributed to faulty or degraded seals, joints, or fittings. The effluent and contaminants move according to the permeability of surrounding soils at various points of release. Low-mobility contaminants such as cesium and plutonium sorb near points of release, and concentrations decrease with depth.
3. Fractures, cracks, and breaks are more prevalent in some pipelines such as those constructed of vitrified clay. Larger breaks where flow was under pressure may have resulted in releases that extend both above and below the pipe into surrounding soil.
4. Contamination extends above the pipeline to the surface in some places because of uptake by vegetation (or possible animal intrusion).
5. Surficial dispersion of contaminants may occur around some swab risers, caused by vent releases or sampling activities.
6. Mobile contaminants such as nitrate and tritium migrate with the moisture front to greater depths.
7. Process fluids and contaminants may or may not impact groundwater, depending on the volume of releases.

Figure 1-6. Preliminary Conceptual Contaminant Distribution Model for a Diversion Box and Catch Tank.



1. Leaks into the interior of the diversion box occur when jumper connections are changed or during a misrouting. Although most of the spill drains to the catch tank, some contamination remains on the interior floor or sides of the box.
2. During routing changeouts or maintenance activities, cover blocks are removed, exposing the diversion box interior to the environment. Winds, remote-handling activities, and removal of equipment generate unplanned releases on the ground surface around the structure. This is the most common type of unplanned release at these structures and usually is stabilized with a cover of clean soil. Vegetation uptake or animal activities may remobilize the contamination.
3. During a misrouting, in some cases, waste liquids fill the diversion box and flow onto the ground around the structure. The liquid drains into the soil, and contaminants are distributed according to respective K_d values and soil characteristics. . Immobile contaminants such as plutonium and cesium remain close to the point of release; mobile contaminants such as technetium-99 and nitrate migrate with the moisture front. This type of unplanned release is very rare for these structures. The contaminated soil is covered with clean soil, shotcrete, or asphalt.
4. Pipe connections may fail at the diversion box exterior wall. Liquid is released to the soil column below ground and flows away from the break. Depending on the volume of the release, liquid flow may induce localized ground subsidence, with contaminated liquids emerging at the ground surface or in the depression (not shown). Contaminants are retained in the soil column according to respective K_d values and soil characteristics.. Immobile contaminants such as plutonium and cesium remain close to the point of release; mobile contaminants such as technetium-99 and nitrate migrate with the moisture front. The area of surface contamination is covered with clean soil, shotcrete, asphalt, or other material.
5. Failure at a pipe fitting, or failure of the tank itself, leads to a loss of waste to the subsurface. The volume of waste lost is assumed to be low, because most releases to catch tanks are assumed to be the sum of multiple jumper contents lost when routings were broken. Liquids move down through the soil column, while contaminants are retained in the soil according to respective K_d values and soil characteristics. Immobile contaminants such as plutonium and cesium remain close to the point of release; mobile contaminants such as technetium-99 and nitrate migrate with the moisture front. This type of failure is rare, but several replacement catch tanks have been installed at diversion boxes.
6. Surface releases around catch tank risers occur primarily when access to the tank is required for liquid-level measurement, sampling, or pumping. Opening the system to the environment allows vapors to escape or wind to mobilize contaminants in the riser. Sampling devices and pumps lowered into the tank to remove liquids entrain contaminants to the surface when removed, and contaminants are scattered by leaks, drips, or wind. Rarely, overflows at diversion box/catch tank pairs lead to releases through catch tank risers. Liquids move down through the soil column, while contaminants are retained in the soil according to respective K_d values and soil characteristics. Immobile contaminants such as plutonium and cesium remain close to the point of release; mobile contaminants such as technetium-99 and nitrate migrate with the moisture front. Releases are covered with clean soil to prevent spread of the radionuclides.

1.14 PROBLEM STATEMENT

Problem Statement:

Given that the process waste pipeline systems in the Central Plateau received waste discharges, the problem is to determine from process history and/or data collection and analysis whether pipelines or surrounding soils contain constituents that are above regulatory and/or risk thresholds.

DQO Approach:

The DQO process is being performed for the 200-IS-1 OU to determine if the process waste pipeline systems have been contaminated at levels that require remedial action.

A SAP will be developed after completion of the DQO process, which specifies the sampling and analyses to be performed for characterization of the process waste pipeline systems.

The 200-IS-1 OU process waste pipeline systems will be evaluated on the basis of anticipated future land use.

2.0 STEP 2 – IDENTIFY THE DECISION

The purpose of DQO Step 2 is to define the principal study questions (PSQ) that need to be resolved to address the problems identified in DQO Step 1 and the alternative actions (AA) that would result from resolution of the PSQs. The PSQs and AAs then are combined into decision statements (DS) that express a choice among AAs.

Table 2-1 presents the task-specific PSQs, AAs, and resulting DSs. This table also provides a qualitative assessment of the severity of the consequences of taking an AA if it is incorrect. This assessment only takes into account ramifications to human health and the environment (flora/fauna). The relative severity of the consequences of erroneous actions is expressed as low, moderate, or severe. Low-severity consequence would have minimal or no short- or long-term impacts to human health or the environment. Consequences identified as severe could pose a high risk to human health or the environment. The determination of moderate severity is a subjective determination by the DQO team participants and normally is assigned to waste sites with moderate contamination levels.

If multiple sampling designs are developed, cost comparisons will be completed to support the sampling design selection process. Economic impacts associated with remedial decisions will be evaluated in the FS, as applicable.

Table 2-1. Summary of Data Quality Objectives Step 2 Information. (3 Pages)

PSQ-AA #	Alternative Action	Consequences of Erroneous Actions	Human Health and Environ-mental Severity of Conse-quences
PSQ #1— Is there chemical constituent(s) within the pipeline systems?			
1-1a	Evaluate the need for remedial action alternatives in an FS.[a]	The pipeline systems may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
1-1b	Evaluate leaving pipelines in place (no-action alternative) in an FS.[a]	The pipeline system may be closed out inappropriately without remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
1-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to pipeline system decision-making, based on field-screening data and/or analytical data and take appropriate actions.[a]	The pipeline systems may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
1-3	Evaluate the need for additional sampling.[a]	The pipeline system sampling may be based on an insufficient number of samples and may be closed out without needed remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
DS #1— Determine if there is chemical constituent(s) within the pipeline systems and select an appropriate AA.			

Table 2-1. Summary of Data Quality Objectives Step 2 Information. (3 Pages)

PSQ-AA #	Alternative Action	Consequences of Erroneous Actions	Human Health and Environmental Severity of Consequences
PSQ #2— Is there chemical constituent(s) in the surrounding soil?			
2-1a	Evaluate the need for remedial action alternatives in an FS. [a]	The surrounding soils may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
2-1b	Evaluate the no-action alternative in an FS. [a]	The surrounding soils may be closed out inappropriately without remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
2-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to pipeline system decision-making, based on field-screening data and/or analytical data and take appropriate actions. [a]	The surrounding soils may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
2-3	Evaluate the need for additional sampling. [a]	The pipeline system sampling may be based on an insufficient number of samples and may be closed out without needed remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
DS #2— Determine if there is chemical constituent(s) within the surrounding soils and select an appropriate AA.			
PSQ #3— Is there radiological constituent(s) within the pipeline systems ?			
3-1a	Evaluate the need for remedial action alternatives in an FS. [a]	The pipeline systems may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
3-1b	Evaluate leaving pipelines in place (no-action alternative) in an FS. [a]	The pipeline system may be closed out inappropriately without remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
3-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to pipeline system decision-making, based on field-screening data and/or analytical data and take appropriate actions. [a]	The pipeline systems may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
3-3	Evaluate the need for additional sampling. [a]	The pipeline system sampling may be based on an insufficient number of samples and may be closed out without needed remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
3-4	Evaluate the need for remedial action alternatives that include TRU waste in an FS. [a]	The pipeline systems may be remediated inappropriately and include costly and difficult processes for handling TRU waste, resulting in unnecessary expenditure of funds.	Low
3-5	Evaluate the need for remedial action alternatives that includes greater than Class C waste concentrations in an FS. [a]	The pipeline systems may be remediated inappropriately and include costly and difficult processes for handling greater than Class C waste concentrations, resulting in unnecessary expenditure of funds.	Low
DS #3— Determine if there is radiological constituent(s) within the pipeline systems and select an appropriate AA.			

Table 2-1. Summary of Data Quality Objectives Step 2 Information. (3 Pages)

PSQ-AA #	Alternative Action	Consequences of Erroneous Actions	Human Health and Environmental Severity of Consequences
PSQ #4— Is there radiological constituent(s) within the surrounding soil ?			
4-1a	Evaluate the need for remedial action alternatives in an FS. [a]	The surrounding soils may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
4-1b	Evaluate the no-action alternative in an FS. [a]	The surrounding soils may be closed out inappropriately without remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
4-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to pipeline system decision-making, based on field-screening data and/or analytical data and take appropriate actions. [a]	The surrounding soils may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
4-3	Evaluate the need for additional sampling. [a]	The pipeline system sampling may be based on an insufficient number of samples and may be closed out without needed remedial action, increasing risks of potential exposure to workers and the environment.	Moderate to Severe
4-4	Evaluate the need for remedial action alternatives that include TRU waste in an FS. [a]	The pipeline systems may be remediated inappropriately and include costly and difficult processes for handling TRU waste, resulting in unnecessary expenditure of funds.	Low
4-5	Evaluate the need for remedial action alternatives that includes greater than Class C waste concentrations in an FS. [a]	The pipeline systems may be remediated inappropriately and include costly and difficult processes for handling greater than Class C waste concentrations, resulting in unnecessary expenditure of funds.	Low
DS #4— Determine if there is radiological constituent(s) within the surrounding soil and select an appropriate AA.			
PSQ #5— Is the constituent(s) within the pipeline systems dangerous waste in accordance with WAC 173-303?			
5-1a	Evaluate the need for remedial action alternatives in an FS. [a]	The pipeline systems may be remediated inappropriately, resulting in unnecessary expenditure of funds.	Low
5-1b	Evaluate the no-action alternative in an FS. [a]	The pipeline systems may be closed out inappropriately without remedial action, increasing risks of potential exposure to workers and the environment.	Severe
DS #5— If the constituent(s) is a dangerous waste in accordance with WAC 173-303, then select an appropriate AA.			

[a] May include innovative decision-making approaches (e.g., probabilistic, decision-analysis modeling).
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.
10 CFR 61.55, "Licensing Requirements for Land Disposal of Radioactive Waste," "Waste Classification."

AA = alternative action.
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
FS = feasibility study.
PSQ = principal study question.
ROD = record of decision.
TRU = radioactive waste containing more than 100 nCi/g (3700 Bq/g) of alpha-emitting transuranic isotopes with half-lives greater than 20 years, other than the exceptions noted in DOE G 435.1-1, Chapter 3, "Transuranic Waste Requirements."

This page intentionally left blank.

3.0 STEP 3 – IDENTIFY THE INPUTS TO THE DECISION

The purpose of DQO Step 3 is to identify the types of data needed to resolve each of the DSs identified in DQO Step 2. The data may exist already or may be derived from computational or surveying/sampling and analysis methods. Analytical performance requirements (e.g., practical quantitation limit, precision, and accuracy) are also provided in this step for any new data that need to be collected.

3.1 INFORMATION REQUIRED TO RESOLVE PRINCIPAL STUDY QUESTIONS

Table 3-1 specifies the information (data) required to resolve each of the PSQs identified in Table 2-1 and identifies whether the data already exist. For the data that are identified as existing, the source references for the data have been provided with a qualitative assessment as to whether or not the data are of sufficient quality and quantity to resolve the corresponding PSQ.

Based on the evaluation of process information and existing data, sampling is required to determine remedial alternative(s) for the process-waste pipeline systems in the 200-IS-1 OU. Additional data to determine if releases from the process-waste pipeline systems have impacted the vadose zone are required to support remedial decision-making.

3.2 BASIS FOR SETTING THE PRELIMINARY ACTION LEVELS AND APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The preliminary action level is the threshold value that provides the criterion for choosing between AAs. Table 3-2 identifies the decision statements and basis (that is, regulatory threshold or risk based) for establishing the preliminary action level for each of the COPCs. Preliminary ARARs identified for the remedial actions within the 200 Areas are presented in the Implementation Plan (DOE/RL-98-28). Using the Implementation Plan as the basis, a preliminary set of ARARs for the 200-IS-1 DQO is presented in Table 1-7. ARARs associated with potential alternative actions will be refined further in the FS.

Table 3-1. Required Information and Reference Sources. (3 Pages)

Principal Study Question or Objective	Required Information Category	Do Data Exist? (Y/N)	Reference Source	Are Available Data of Sufficient Quality and Quantity to Complete the RI/FS process? (Y/N)	Are Additional Data Required to Support the RI/FS process? (Y/N)
PSQ 1 - **Is there chemical constituent(s) within the pipeline systems that pose an unacceptable risk to human health and the environment?**	Residuals chemical data	Y	See Table A-1 in Appendix A.	N	Y
PSQ 2 - **Is there chemical constituent(s) in the surrounding soil that pose an unacceptable risk to human health and the environment?**	Soil chemical data	Y	See Table A-1 in Appendix A.	Data exist for certain pipelines. Additional investigation required in Step 4.	Y
PSQ 3 -**Is there radiological constituent(s) within the pipeline systems that pose an unacceptable risk to human health and the environment?**	Residuals radiological data	Y	See Table A-1 and Table A-2 in Appendix A.	N	Y
PSQ 4 - **Is there radiological constituent(s) within the surrounding soil that pose an unacceptable risk to human health and the environment?**	Soil radiological data	Y	See Table A-1 and Table A-2 in Appendix A.	Data exist for certain pipelines. Additional investigation required in Step 4.	Y
PSQ 5 --**Is the constituent(s) within the pipeline systems dangerous waste in accordance with WAC 173-303?**	Residuals chemical data	Y	*Tank Waste Information Network System* database	N	Y
		Y	RPP-25113, provides historical information on plugged pipelines and estimated residual waste inventories.	N	Y

Table 3-1. Required Information and Reference Sources. (3 Pages)

Principal Study Question or Objective	Required Information Category	Do Data Exist? (Y/N)	Reference Source	Are Available Data of Sufficient Quality and Quantity to Complete the RI/FS process? (Y/N)	Are Additional Data Required to Support the RI/FS process? (Y/N)
Project objectives 6,7,8 – Data to support contaminant transport and risk models	Physical properties of moisture content, particle size distribution, and lithology	Y	WHC-SD-EN-TI-014, presents site-specific data for the 200 East Area that can be used to calculate soil density, hydraulic conductivity, and porosity.	Y	No Data Available
			WHC-SD-EN-TI-290, presents site-specific data for the 200 West Area that can be used to calculate soil density, hydraulic conductivity, and porosity.	Y	N
			WHC-EP-0883, provides mean values for hydraulic properties in 200 Areas soils.	Y	N
Project objectives 6,7,8 – Data to support contaminant transport and risk models	Distribution Coefficients	Y	PNNL-13895, Rev.1, provides a compilation of K_d values for those radionuclides and toxic compounds within Hanford Site sediments that have the greatest potential for driving risk.	Y	Y
			PNNL-11800, provides 200 Areas distribution coefficients for various waste stream types and Hanford Site soils.	Y	N
			PNNL-13037, provides 200 Areas distribution coefficients for various waste stream types and Hanford Site soils.	Y	N
			DOE/RL-92-70, provides 200 Areas distribution coefficients for 200-BP-1 Operable Unit waste streams and Hanford Site soils.	Y	N
	RESRAD Modeling	Y	ANL/EAD-4 and ANL, 2002. Input parameters are defined in these manuals that can be determined based on existing information or RESRAD defaults.	Y	N
			ANL, 2006	Y	N
			WDOH/320-015, provides additional guidance on input parameters for use with RESRAD.	Y	N

Table 3-1. Required Information and Reference Sources. (3 Pages)

Principal Study Question or Objective	Required Information Category	Do Data Exist? (Y/N)	Reference Source	Are Available Data of Sufficient Quality and Quantity to Complete the RI/FS process? (Y/N)	Are Additional Data Required to Support the RI/FS process? (Y/N)

ANL, 2002, *RESRAD for Windows*, Version 6.21.
ANL, 2006, *RESRAD-BIOTA*, Version 1.2.
ANL/EAD-4, *User's Manual for RESRAD, Version 6.*
DOE/RL-92-70, *Phase I Remedial Investigation Report for 200-BP-1 Operable Unit.*
DOE/RL-2003-11, *Remedial Investigation for the 200-CW-5 U Pond/ Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-CS-1 Steam Condensate Group Operable Units.*
PNNL-11800, *Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site.*
PNNL-13037, *Geochemical Data Package for the Hanford Immobilized Low-Activity Tank Waste Performance Assessment (ILAW PA).*
PNNL-13895, *Hanford Contaminant Distribution Coefficient Database and Users Guide.*
RPP-25113, *Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site.*
Tank Waste Information Network System, Hanford Site database.
WDOH/320-015, *Hanford Guidance for Radiological Cleanup.*
WHC-EP-0883, *Variability and Scaling of Hydraulic Properties for 200 Area Soils, Hanford Site.*
WHC-SD-EN-TI-014, *Hydrogeologic Model of the 200 West Groundwater Aggregate Area.*
WHC-SD-EN-TI-290, *Geologic Setting of the Low-Level Burial Grounds.*

K_d = distribution coefficient.
N = no.
PSQ = principal study question.
RESRAD = RESidual RADioactivity dose model.
RI/FS = remedial investigation/feasibility study.
TRU = transuranic.
Y = yes.

Table 3-2. Basis for Setting Preliminary Action Level.

DS #	COPCs	Basis for Setting Preliminary Cleanup Level
1,2	Nonradiological COPCs	Inside the Central Plateau land-use boundary Industrial land-use scenario - WAC 173-340-745(5) Method C cleanup levels with contaminant-specific variations. (0-15 ft bgs) direct contact. (See Global Issue 1 raised by Ecology October 11, 2006, in Chapter 1.0.)
		Outside the Central Plateau land-use boundary Unrestricted land-use scenario - WAC 173-340-740(3) Method B cleanup levels with contaminant-specific variations. (0-15 ft bgs) direct contact
		Ecological - WAC 173-340-7493 and WAC 173-340-900, Table 749-3 (0-6 ft bgs conditional point of compliance and 0-15 ft bgs point of compliance)
		Groundwater protection - WAC 173-340-747(4) Method B
3,4	Radiological COPCs	Inside the Central Plateau land-use boundary Industrial land-use scenario (15 mrem/yr, 0-15 ft bgs), OSWER 9200.4-18 (EPA, 1997), (TBC). RESRAD analysis to determine concentration values (ANL, 2002)
		Outside the Central Plateau land-use boundary Unrestricted land-use scenario (15 mrem/yr, 0-15 ft bgs), OSWER 9200.4-18 (EPA, 1997), (TBC). RESRAD analysis to determine concentration values (ANL, 2002)
		Groundwater protection - MCLs, state, and Federal ambient-water quality-control criteria. RESRAD analysis to determine concentration values in soil (ANL, 2002)
		Ecological - RESRAD-BIOTA (ANL, 2006)
5	Dangerous Waste	WAC 173-303

[a] Based on DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement.*

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste."
10 CFR 61.55, "Licensing Requirements for Land Disposal of Radioactive Waste," "Waste Classification."
10 CFR 834, "Radiation Protection of the Public and the Environment," proposed rule.
40 CFR 191.12, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," "Definitions."
ANL, 2002, *RESRAD for Windows*, Version 6.21.
ANL, 2006, *RESRAD-BIOTA*, Version 1.2.
DOE/EIS-0222-F, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement.*
EPA, 1997, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, OSWER Directive 9200.4-18.
WAC 173-303, "Dangerous Waste Regulations."
WAC 173-340-740(3), "Unrestricted Land Use Soil Cleanup Standards," "Method B Soil Cleanup Levels for Unrestricted Land Use."
WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels."
WAC 173-340-747(4), "Deriving Soil Concentrations for Ground Water Protection," "Fixed Parameter Three-Phase Partitioning Model."
WAC 173-340-900, "Tables."
WAC 173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures."

ARAR = applicable or relevant and appropriate requirement.
bgs = below the ground surface.
COPC = contaminant of potential concern.
DS = decision statement.
MCL = maximum contaminant level.
POC = point of compliance.
RESRAD = RESidual RADioactivity dose model.
TBC = to be considered.
TRU = transuranic.

3.3 COMPUTATIONAL AND SURVEY/ ANALYTICAL METHODS

Table 3-3 identifies the DSs where existing data either do not exist or are of insufficient quality to resolve the DSs. For these DSs, Table 3-3 presents computational and surveying/sampling methods that could be used to obtain the required data.

Table 3-3. Information Required to Resolve the Decision Statements. (2 Pages)

DS # or Objective	Remedial Investigation Variable	Required Data	Evaluation Methods	Survey/Analytical Methods
1	Concentrations of nonradiological COPCs within pipeline systems	Concentrations for nonradiological COPC (e.g., inorganic metals and anions, VOCs and semivolatile organic compounds) within pipeline systems for evaluation against potential ARARs and CULs.	WAC 173-340-745(5) Method C or WAC 173-340-740(3) Method B values for human-health risk assessment. (See Global Issue 1 raised by Ecology October 11, 2006, in Chapter 1.0.) WAC 173-340-900 Table 749-3 values for ecological risk. STOMP (PNNL-12028) or other analytical code transport modeling through vadose zone to groundwater Pipeline release models.	- Field screening using chemical detection equipment. - Sampling and laboratory analysis of residual material.
2	Concentrations of nonradiological COPCs in vadose zone soils.			- Field screening with chemical detection equipment - Soil sampling and laboratory analysis.
3,	Concentrations of radiological COPCs within pipeline systems.	Alpha, beta, and gamma activity and/or COPC concentrations for evaluation against potential ARARs and CULs.	RESRAD (ANL, 2002) and RESRAD-BIOTA (ANL, 2006)—analytical modeling method for human health and ecological dose assessment (all pathways). RESRAD and RESRAD-BIOTA, STOMP (PNNL-12028), or other analytical code transport modeling through vadose zone to groundwater. Pipeline release models.	- Field screening with hand-held or deployed radiological detection equipment. - Sampling and laboratory analysis of residual material.
4,	Concentrations of radiological COPCs in vadose zone soils.	Alpha, beta, and gamma activity and COPC concentrations in soils for evaluation against potential ARARs and CULs.		- Field screening with hand-held radiological detection equipment. - Driven soil probes or borehole logging with downhole radiological detectors. Soil sampling and laboratory analysis.
Project objective 10	Contaminant distribution	Location data (vertical and lateral extent of COPCs within waste site boundaries).	Evaluate contaminant distribution model against empirical data	Identified with DSs above
Project objectives 6, 7, and 8	Physical properties in vadose zone soils.	Moisture content, bulk density, particle size distribution.	RESRAD and RESRAD-BIOTA, STOMP, or other transport models Pipeline release models.	Soil sampling and laboratory analysis.

Table 3-3. Information Required to Resolve the Decision Statements. (2 Pages)

DS # or Objective	Remedial Investigation Variable	Required Data	Evaluation Methods	Survey/Analytical Methods
5	Dangerous waste	Concentrations of mixed waste and chemical constituents, characteristics of waste, listed waste from TSD pipelines	WAC 173-303	Sampling and laboratory analysis.

ANL, 2002, *RESRAD for Windows*, Version 6.21.
ANL, 2006, *RESRAD-BIOTA*, Version 1.2.
PNNL-12028, *STOMP Subsurface Transport Over Multiple Phases, Version 2.0, Application Guide.*
WAC 173-303, "Dangerous Waste Regulations."
WAC 173-340-740(3), "Unrestricted Land Use Soil Cleanup Standards," "Method B Soil Cleanup Levels for Unrestricted Land Use."
WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels."
WAC 173-340-900, "Tables."

ARAR = applicable or relevant and appropriate requirement.
COPC = contaminant of potential concern.
CUL = cleanup level.
DS = decision statement.
RESRAD = RESidual RADioactivity dose model.
STOMP = subsurface transport over multiple phases.
VOC = volatile organic compound.

A summary of the computational evaluations identified in Table 3-3 is presented below.

- Surface transport over multiple phases (STOMP) – Transport model developed by Pacific Northwest National Laboratory to estimate migration of radiological and nonradiological constituents through the vadose zone to groundwater. Uses site-specific geohydrologic soil properties such as hydraulic conductivity and moisture (PNNL-12028, *STOMP Subsurface Transport Over Multiple Phases, Version 2.0, Application Guide*).

- Residual radioactivity dose model (RESRAD) – Model developed by Argonne National Laboratory to estimate radiological dose at selected exposure points for human health risk assessment (ANL, 2002, *RESRAD for Windows*, Version 6.21).

- RESRAD-BIOTA – Model to estimate radiological concentrations at selected exposure points for ecological risk assessment (ANL, 2006, *RESRAD-BIOTA*, Version 1.2).

A number of methods of investigation may be required to evaluate the condition of pipeline systems and determine if contamination is present in the pipeline interior or in the surrounding soil. The following discussion presents evaluation methods that may be used to provide the required information needed to resolve each of the DSs.

3.3.1 Surface Geophysical Techniques for Pipeline Evaluations

Several geophysical techniques are available and could be used as needed to gather information on buried pipelines. Additional discussion on surface geophysical techniques is provided in EPA/625/R-92/007, *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: A Reference Guide.*

3.3.1.1 Magnetometry

Magnetometers permit rapid, non-contact surveys to locate buried metallic objects or features. Portable (one-person) field units can be used virtually anywhere that a person can walk, although they can be sensitive to local interferences, such as fences and overhead wires. Field-portable magnetometers may be single- or dual-sensor. Dual-sensor magnetometers are called gradiometers; they measure gradient or the magnetic field; single-sensor magnetometers measure total field. Magnetic surveys typically are run with two separate magnetometers. One magnetometer is used as the base station to record the earth's primary field. The other magnetometer is used as the rover to measure the spatial variation of the earth's field. The rover magnetometer is moved along a predetermined linear grid laid out at the site.

3.3.1.2 Ground-Penetrating Radar and Electromagnetic Induction

Surface geophysical surveys using ground-penetrating radar (GPR) and electromagnetic induction (EMI) techniques could be used to verify the locations of pipelines as needed. GPR uses a transducer to transmit frequency module electromagnetic energy into the ground. Interfaces in the ground, defined by contrasts in dielectric constants, magnetic susceptibility, and, to some extent, electrical conductivity, reflect the transmitted energy. The GPR system measures the travel time between transmitted pulses and the arrival of reflected energy. The reflected energy provides the means for mapping subsurface features of interest. The display and interpretation of GPR data are similar to those used for seismic reflection data. When numerous adjacent profiles are collected, often in two orthogonal directions, a plan view map showing the location and depth of underground features can be generated.

The EMI technique is a non-invasive method of detecting, locating, and/or mapping shallow subsurface features. It complements GPR because of its response to metallic subsurface anomalies and because it provides reconnaissance-level information over large areas to help focus GPR activities. The EMI techniques are used to determine the electrical conductivity of the subsurface and generally are used for shallow investigations. The method is based on a transmitting coil radiating an electromagnetic field that induces eddy currents in the earth. A resulting secondary electromagnetic field is measured at a receiving coil as a voltage that is linearly related to the subsurface conductivity.

3.3.1.3 Resistivity

The resistivity method is based on the capacity of earth materials to conduct electrical current. Earth resistivity is a function of soil type, porosity, moisture, and dissolved salts. The concept behind applying the resistivity method is to detect and map changes or distortions in an imposed electrical field that are caused by heterogeneities in the subsurface. Resistivity is a volumetric property measured in ohm-meters. Because it is not possible to know the exact volume of the mass of earth being measured under field conditions, readings are in terms of apparent resistivity. Field data are acquired using an electrode array. A four-electrode array employs an electric current injected into the earth through one pair of electrodes (transmitting dipole) and measuring the resultant potential by the other pairs (receiving dipole). High-resolution resistivity methods generally employ a "pole-pole" array. For a pole-pole array, the two rover or "active" electrodes are incrementally spaced from 5 to 400 m apart.

3.3.2 Evaluation of Soils Adjacent to Pipelines, Diversion Boxes, and Associated Structures

Investigations for the presence of contaminants in the soils surrounding pipeline systems could be conducted using both indirect and direct evaluation techniques. Subsurface investigations could include geophysical and/or soil sampling methods.

3.3.2.1 Direct-Push Cone Penetrometer Technology

Direct-push subsurface investigative techniques could be employed as part of the assessment for selected pipeline structures. Cone penetrometer technology provides rapid cost-effective, real-time data and limits generation of IDW. This technology can be used to collect information relating to a number of in situ soil characteristics including organic and inorganic compound concentrations, gamma radiological levels, soil moisture, and permeability. A particular advantage of this technology is that no sample collection is required, because measurements are taken directly within the soil. Detector probes are pushed to the required depth of investigation using truck-mounted hydraulic force. This technology could work well in the unconsolidated sediments and fill material adjacent to buried pipelines.

3.3.2.2 Geophysical Logging through Driven Small-Diameter Casing

Radioactivity levels can be measured in soils using geophysical instrumentation. Based on process knowledge, radioactive contamination is generally expected to be represented by gamma emitters (e.g., cesium-137). Driven small-diameter casing can be installed and used for down-hole logging with gamma-logging tools. The depth of a driven casing is limited by the subsurface conditions (i.e., cobbles or gravel). Gross gamma and passive neutron logging probes may be used to determine areas of high Am-241 and Pu-239/240 concentrations. The small-diameter gross gamma and passive neutron probe system uses bismuth-germanium detector instrumentation for gross counting of the gamma-emitting radionuclides in the soil as a function of depth. The passive neutron logging instrument with a nHe-3 detector can be configured to detect the neutron flux present in the below-ground soil environment.

3.3.2.3 Direct-Push Soil Sample Collection

Cone-penetrometer technology equipment can be configured to collect soil samples, if needed. Other direct-push applications such as the GeoProbe[1] or Enviro-Core[2] sampling devices also can be used with core samplers for small-volume soil-sample collection.

3.3.2.4 Soil-Gas Surveys Using Direct-Push Equipment

Determination of soil-gas concentrations could be performed adjacent to pipelines or diversion boxes that are known to have handled process-waste streams that included volatile organic compounds. A drive point would be pushed to a desired depth for sampling using a series of

---

[1] GeoProbe is a registered trademark of GeoProbe Systems, Salina, Kansas.

[2] Enviro-Core is a trademark of Precision Sampling, Inc., Richmond, California.

push rods. A mesh, stainless-steel sampling port would be exposed and connected to the surface by tubing placed within the center of the push rods. The sampling port would be used to extract in situ soil gas. Results of these analyses could be used as an indicator of the presence of volatile organic compounds in the soil matrix.

3.3.2.5 Test Pit Excavation and Sampling

The test pits could be used at selected locations for direct inspection of areas of interest, such as suspected leak locations below or adjacent to structures. Depth of exploratory excavations and associated soil sampling would be based on site-specific conditions. Evaluations using test pits would be limited to a depth of approximately 7.6 m (25 ft).

3.3.2.6 Drilling and Sampling

Site-specific conditions may require deeper subsurface evaluations and the collection of soil samples. When available information indicates the presence of vadose-zone contamination to depths greater than approximately 18.3 m (60 ft), installation of vertical boreholes would be conducted with a drill rig. Split-spoon samplers would be used to collect samples for laboratory analyses.

3.3.3 Evaluation of Pipe Interiors

Inspection of the interiors of pipelines may be required if specific information is needed. Analyses could include both visual inspections and/or sampling activities. Inspections could be used to evaluate for breaks, breaches, or cracks in the pipeline; presence or absence of blockage along a pipeline segment; and characterization of residual waste, if present. Visual inspections could be conducted directly or remotely, depending on access availability and a hazard assessment. Evaluations could include camera surveys, radiological monitoring, and sampling.

3.3.3.1 Camera Surveys

Examination of the interior of pipelines could be performed using a camera, for pipeline segments where access is available and exposure hazards are manageable. This investigative technique could provide real-time information on the current conditions within buried pipelines. Camera surveys/inspections would reveal if corrosion, debris, or waste residue were present. Areas where leakage may have occurred could be identified and generally would be visible as cracks, breaks, or gaps in pipe connections. The inspections also could indicate those pipeline segments that are fully intact, open, and dry and show no signs of past failure or leakage.

3.3.3.2 Radiological Surveys

Radiological surveys of pipeline interiors could provide information concerning the presence or absence of residual radiological contamination. A number of deployment systems are available; some include a configuration with camera survey equipment. Alpha, beta, and gamma radiation detectors can be used with some systems.

3.3.3.3 Sampling Pipe Residue

In some cases, residual build-up of sediment, slug, or scale may be present in the interiors of some pipelines. Sampling and analysis of this material may be required to determine constituent composition for risk calculations, remedial decisions, and/or disposal considerations. Grab or swipe samples could be collected, depending on the evaluation and constituent of interest.

3.3.3.4 Emerging and Innovative Technologies

An emerging technology is an innovative technology that currently is undergoing bench-scale testing in which a small version of the technology is tested in a laboratory. An innovative technology is a technology that has been field-tested and applied to a waste problem at a site but that lacks a long history of full-scale use. Information about its cost and how well the technology works may be insufficient to support prediction of its performance under a wide variety of operating conditions. As these technologies are identified, they will be evaluated for application to pipeline interiors.

3.3.4 Field Screening

Field screening method could be used for assessment of radioactivity or nonradiological contamination at selected locations. Field screening techniques would be used principally for semiquantitative evaluations of contamination (Tables 3-4a, 3-4b, and 3-4c).

Table 3-4a. Potentially Appropriate Hand-Held Radiological Field-Screening Methods.

Measurement Type	Emission Type	Method/Instrument	Detection Limit
Exposure/dose rate	Beta/gamma	RO-20/RO-03 portable ionization chamber	0.5 mrem/h
Contamination level	Alpha	100 cm^2 portable alpha meter or equivalent instrument	90 d/min α/100 cm^2 (10 s static count) 250 d/min α/100 cm^2 (1 in/s scan speed)
Contamination level	Beta/gamma	100 cm^2 ruggedized scintillation detector or equivalent	500 d/min β–γ/100 cm^2 (20 s static count @ 13% efficiency) 1,400 d/min β–γ/100 cm^2 (2 in/s scan speed)
Contamination level	Gamma	2 in x 2 in NaI detector (e.g., Ludlum 44-3 or equivalent)	~ 5 pCi/g Cs-137 in soils
Contamination level	Gamma	2 in x 10 mm NaI low energy gamma detector (e.g., Eberline PG-2 or equivalent)	20 pCi/g Am-241 in soils

Eberline PG-2, RO-20, and RO-03 are trademarks of Eberline Instruments, a subsidiary of Thermo Electron Corporation, Waltham Massachusetts.
Ludlum 44-3 is a trademark of Ludlum Measurements, Inc., Sweetwater, Texas.
NaI = sodium iodide.

Table 3-4b. Potentially Appropriate Nonradiological Field-Screening Methods. (2 Pages)

Measurement Variable	Potentially Appropriate Measurement Method [a]	Possible Limitations or Reservations
Arsenic	X-ray fluorescence [b]	DL (75 mg/kg)
Barium	X-ray fluorescence [b]	DL (300 mg/kg)
Cadmium	X-ray fluorescence [b]	DL (75 mg/kg)
Chlorine (chlorinated compounds)	X-ray fluorescence [b]	Calibration and correlation to compound of interest; DL is unknown
Chromium (total)	X-ray fluorescence [b]	DL (400 mg/kg)
Chromium (VI)	Water extraction and colorimetric analysis	Interferences (iron) and soil alkalinity. DL (2 to 5 mg/kg)
Lead	X-ray fluorescence [b]	DL (100 mg/kg)
Mercury	Mercury vapor monitor	DL associated with soil concentrations well above the remedial action goal
Mercury	Immunoassay	DL (0.5 mg/kg). Results reported within a prespecified range. Analysis takes 15 to 30 minutes.
Mercury	X-ray fluorescence [b]	DL (100 mg/kg)
Selenium	X-ray fluorescence [b]	DL (200 mg/kg)
Silver	X-ray fluorescence [b]	DL (100 mg/kg)
Zinc	X-ray fluorescence [b]	DL (400 mg/kg)
Sulfate	X-ray fluorescence [b]	Calibration and correlation to elemental sulfur required
Polyaromatic hydrocarbons	Immunoassay	DL (1 to 5 mg/kg). Results reported within a prespecified range. Analysis takes 15 to 30 minutes.
Polychlorinated biphenyls	Immunoassay	DL (0.1 to 0.3 mg/kg). Results reported within a prespecified range. Analysis takes 15 to 30 minutes.
Nitrate	Colorimetric or Immunoassay	DL (10 to 500 mg/kg). Analyses performed using test strips and reflectometer.
Total petroleum hydrocarbons	Immunoassay	DL (5 to 10 mg/kg). Results reported within a prespecified range. Need to know whether gasoline or diesel products. Analysis takes 15 to 30 minutes.
VOCs	Colorimetric tube	Tube capability must be compared to the site-specific need to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest.
VOCs	Flame ionization detector (e.g., Foxboro OVA 128) [c]	DL (1 to 5 mg/kg, methane-equivalent). Instrument capability must be compared to the site-specific need, to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. Limited to hydrogen containing compounds.
VOCs	Photoacoustic infrared analyzer (e.g., B&K 1302) [d]	Instrument capability must be compared to the site-specific need to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest.

Table 3-4b. Potentially Appropriate Nonradiological Field-Screening Methods. (2 Pages)

Measurement Variable	Potentially Appropriate Measurement Method [a]	Possible Limitations or Reservations
VOCs	Photo-ionization detector (e.g., thermo analytical organic vapor monitor)	DL (1 to 5 mg/kg, isobutylene-equivalent). Instrument capability must be compared to the site-specific need, to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. Limited to photo-ionizing compounds at 10.6 eV.
VOCs	Portable gas chromatograph with photo-ionization detector (e.g., Photovac 10S Plus) [c]	DL (sub-mL/m^3 levels depending on VOC of interest). Instrument capability must be compared to the site-specific need, to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. Limited to photo-ionizing compounds at 11.7 eV.
VOCs	Transportable mass spectrometer	Instrument use requires extensive training. Capital cost and setup is high; operational cost is moderate. May be possible to use a mobile laboratory.

[a] Other methods may be identified and implemented in conjunction with technology development.
[b] Metals measurement by X-ray fluorescence requires calibration to site-specific soils. Detection of chromium, aluminum, and sulfur could be greatly enhanced (50 to 100 mg/kg) with the purchase of a silicon-lithium detector with an Fe-55 source at a cost of about $20,000. Requires management of radioactive source (i.e., Am-241, Cm-244, or Fe-55).
[c] Foxboro and OVA 128 are trademarks of The Foxboro Company, Foxboro, Massachusetts.
[d] B&K 1302 is a trademark of Brüel and Kjær, Nærum, Denmark.
[e] Photovac 10S Plus is a trademark of Photovac, Inc., Waltham, Massachusetts.
DL = detection limit. VOC = volatile organic compound.

Table 3-4c. Potentially Appropriate Vadose Zone Screening Methods. (2 Pages)

Media	Data Provided	Potentially Appropriate Method	Comment	Depth of Investi-gation
Vadose zone soil and/or structures	Location of underground structures and/or soil anomalies	GPR	GPR is a radar-reflection surface geophysical survey technique that detects contrasts in di-electric constants in the below-grade environments from the surface. The technique requires subjective interpretation of the reflected signals. Lack of reflective below-grade surfaces or the presence of interfering matrices can complicate or invalidate the findings. The presence of nearby buildings and utilities can interfere with reflected signals. Fines (for example, clay and heavy fly ash) can act as a reflector to the radar signal.	Tens of feet
		EMI	EMI is a surface geophysical survey technique that measures electrical conductivity in below-grade soils, based on detected changes in electrical fields. The results of EMI generally are used to support the interpretation of GPR surveys. Nearby buildings and utilities can cause interferences.	Tens of feet
		Magneto-metry	Surface geophysical technique permitting rapid, non-contact surveys to locate buried metallic objects or features.	Tens of feet to hundreds of feet
Vadose zone soil and/or structures (cont)	Location of underground structures and/or soil anomalies (cont)	Resistivity	Surface geophysical technique that can be used to gather information on the presence in soils of pore conditions related to moisture and/or dissolved salts. Generally used for deeper investigations (tens to hundreds of feet).	Tens of feet to hundreds of feet
Vadose zone soil	Gross and isotopic gamma emissions	Driven soil probes; NaI detector logging	A cone penetrometer-driven soil probe or small-diameter casing is pushed into the soil to the desired depth. A small-diameter NaI detector (or other suitable detector) is used to log the gamma response. May be ineffective in cobbly or rocky soils.	Tens of feet

Table 3-4c. Potentially Appropriate Vadose Zone Screening Methods. (2 Pages)

Media	Data Provided	Potentially Appropriate Method	Comment	Depth of Investi-gation
Vadose zone soil (cont)	Gamma emissions from fission products, Am-241, Pu-239, and Np-237	Borehole spectral gamma ray logging with a high-purity germanium detector	Gamma-ray logging provides the concentration profiles of gamma-emitting radionuclides such as Am-241, Pu-239, and many fission products in a borehole environment. It is considered by some to be more accurate than sampling and laboratory assay, because the assay is performed in situ with less disturbance of the sample, there is higher vertical spatial resolution, and the sample size is much larger. This method also may be more economical than traditional sampling and analysis. This method does not assess radionuclides or daughter products that do not emit gamma rays. The gamma energies from these isotopes are at the low end of the spectrum, which results in high numerical minimum detectable activities and possible matrix effects from other isotopes. This technique requires the use of a single casing (installed by drilling) in contact with the soil formation.	Hundreds of feet
	Neutron emissions from plutonium	Borehole passive neutron logging	Passive neutron logging provides indication of the presence of neutron-emitting isotopes. Because of the very low incidence of spontaneous plutonium fission and alpha-N reactions, the passive neutron profile is orders of magnitude lower than the gamma emissions.	Hundreds of feet
		Driven soil probes; passive neutron logging	A small-diameter casing is pushed into the soil to the desired depth. A small-diameter passive neutron detector is used to log the neutron response. It provides indication of the presence of neutron-emitting isotopes. Because of the very low incidence of spontaneous plutonium fission and alpha-N reactions, the passive neutron profile is orders of magnitude lower than the gamma emissions.	Tens of feet
	Vertical moisture profile	Borehole neutron-neutron moisture logging	Neutron-neutron moisture logs can be used to determine current moisture content profiles of the subsurface through new or existing boreholes. The moisture profiles often are directly correlated to contaminant concentrations, sediment grain size, composition, or subsurface structural features. Moisture profiles may be helpful when evaluating vertical profiles under a waste site and establishing geologic conditions to support contaminant fate and transport modeling. Moisture profiles also may be correlated to reflections identified in ground-probing radar surveys.	Hundreds of feet
	Soil gas VOC concentra-tions	Soil gas collection with vacuum extraction	Uses a driven soil-gas probe for extraction of vapors by pump for collection in sample bags. Vapors are analyzed in a field-laboratory instrument.	Tens of feet

EMI = electromagnetic imaging.
GPR = ground-penetrating radar.
NaI = sodium iodide.
VOC = volatile organic compound.

3.4 ANALYTICAL PERFORMANCE REQUIREMENTS

A comparison of preliminary cleanup levels for the radiological and nonradiological COPCs is presented in Tables 3-5a (radionuclides) and 3-5b (inorganics and organics). Analytical performance requirements for the data that need to be collected to resolve each of the DSs for the COPCs identified for the facility process-waste pipeline systems is provided in Tables 3-6a (radionuclides) and 3-6b (inorganics and organics). Analytical performance requirements for the data that need to be collected to resolve each of the DSs for the COPCs identified for the tank farms process-waste pipeline systems is provided in Tables 3-7a (radionuclides) and 3-7b (inorganics and organics). Analytical performance requirements for the COPCs identified for the tank farms process-waste pipeline systems are targets only and may be impacted by high sample dose rates and/or high constituent concentrations.

Table 3-5a. Comparison of Radionuclide Preliminary Cleanup Levels for All Pathways. (2 Pages)

Analyte	Hanford Site Background [a] (pCi/g)	Inside Core Zone, Industrial Land-Use Scenario, Direct Exposure [b], 15 mrem/yr Dose (pCi/g)	Outside Core Zone, Unrestricted Land-Use Scenario, Direct Exposure [c], 15 mrem/yr Dose (pCi/g)	Terrestrial Wildlife BCG [d] (pCi/g)	Groundwater Protection [e] (pCi/g)	Background or Lowest Overall CUL [f] (pCi/g)
Americium-241	--	335	31.1	3,890	--	31.1
Antimony -125	--	--	--	--	--	--
Carbon-14	--	33,100 [e]	5.16	--	4.65	4.65
Cesium-137	1.05	23.4	6.2	20.8	--	6.2
Cobalt-60	0.00842	4.90	1.4	692	--	1.4
Curium-242	--	--	--	--	--	--
Curium-243	--	110 [e]	--	--	--	110
Curium-244	--	744	--	--	--	744
Europium-152	--	11.4	3.3	1,520	--	3.3
Europium-154	0.0334	10.3	3.0	1,290	--	3.0
Europium-155	0.0539	426	125	15,800	--	125
Iodine-129	--	3,080 [e]	--	--	0.12	0.12
Neptunium-237	--	59.2	2.5	--	--	2.5
Nickel-63	--	3,070,000 [e]	4,026	--	--	4,026
Niobium-94	--	8.25[e]	2.43	--	--	2.43
Plutonium-238	0.00378	470	37.4	--	--	37.4
Plutonium-239/240	0.0248	425	33.9	6,110	--	33.9
Plutonium-241	--	11,100 [e]	--	--	--	11,100
Radium-226	0.815	7.03	--	50.6	--	7.03
Selenium-79	--	197,000 [e]	--	--	--	197,000
Strontium-90	0.178	2,530	4.5	22.5	32.9	4.5
Technetium-99	--	412,000	15	4,490	1.93	1.93

Table 3-5a. Comparison of Radionuclide Preliminary Cleanup Levels for All Pathways. (2 Pages)

Analyte	Hanford Site Background [a] (pCi/g)	Inside Core Zone, Industrial Land-Use Scenario, Direct Exposure [b], 15 mrem/yr Dose (pCi/g)	Outside Core Zone, Unrestricted Land-Use Scenario, Direct Exposure [c], 15 mrem/yr Dose (pCi/g)	Terrestrial Wildlife BCG [d] (pCi/g)	Groundwater Protection [e] (pCi/g)	Background or Lowest Overall CUL [f] (pCi/g)
Thorium-228	1.32 [g]	7.73	--	--	--	7.73
Thorium-230	1.1 [h]	20.1 [e]	--		--	20.1
Thorium-232	1.32	4.80	--	1,510	--	4.8
Tin-126	TBD	TBD	TBD	TBD	TBD	TBD
Tritium (H-3)	--	471 [e]	400	--	48.2	48.2
Uranium-233/234	1.1	2,665	1.1	4,830	--	1.1
Uranium-235	0.109	101	--	2,770	--	101
Uranium-235/236	--	101	1.0	--	0.067	0.067
Uranium-236	--	--	--	--	--	--
Uranium-238	1.06	504	1.1	1,580	0.65	1.06

[a] Unless otherwise noted, values are from DOE/RL-96-12, *Hanford Site Background; Part 2, Soil Background for Radionuclides*, Rev. 0, Table 5-1, lognormal distribution 90%. The U-233/234 value is based on the U-234 value.

[b] Unless otherwise noted, the individual radionuclide activities corresponding to a 15 or 100 mrem/yr dose in an industrial scenario are calculated using ANL, 2002, *RESRAD for Windows*, Version 6.21.

[c] Values from DOE/RL-2004-39, *200-UR-1 Unplanned Release Waste Group Operable Unit Remedial Investigation/Feasibility Study Work Plan and Engineering Evaluation/Cost Analysis*, Table B-4.

[d] DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, Table 6.4 of Module 1 and the associated calculator. The Cs-137 value is based on ANL, 2003, *RESRAD-BIOTA*, Level 1, Version 1.

[e] Values from RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, Table 4-12, Rev. 0.

[f] Values listed represent the most restrictive soil cleanup level. This process takes the most conservative value derived from the evaluation of direct exposure, groundwater, and terrestrial wildlife protection and evaluates this value to ensure that it is not less than natural background and analytical considerations, as indicated in WAC 173-340-700(6)(d), "Overview of Cleanup Standards," "Requirements for Setting Cleanup Levels," "Natural Background and Analytical Considerations."

[g] Derived from DOE/RL-96-12, Table 5-1, lognormal distribution 90%, based on secular equilibrium with Th-232.

[h] Derived from DOE/RL-96-12, Table 5-1, lognormal distribution 90%, based on secular equilibrium with U-234.

"--" no information available.

BCG = biota concentration guide. CUL = cleanup level. TBD = to be determined.

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)
Inorganics							
Aluminum	11,800	--	--	45.2	--	50	45.2
Ammonia (NH_3)	9.23	--	--	--	--	--	9.23
Ammonium (NH_4)	9.23 [e]	--	--	--	--	--	9.23
Antimony	--	1,400	32	5.4	--	5	5
Arsenic (total)	6.47	87.5	0.667	0.034	7	10	6.47
Barium	132	245,000	16,000	923	102	500	132
Beryllium	1.51	7,000	160	63.2	--	10	10
Cadmium	0.81 [f]	3,500	80	0.69	14	4	0.81
Chromium III/Chromium (total)	18.5	5,250,000	120,000 [g]	2,000	67	42 [h]	42
Cobalt	15.7	70,000	1,600	290	--	20	20
Copper	22	130,000	2,960	263	217	50	50
Cyanide	--	70,000	1,600	0.80	--	--	0.8
Ferrocyanide	--	--	--	--	--	--	--
Hexavalent Chromium	--	10,500	240 or 2	0.19	--	--	0.19
Iron	--	--	--	152	--	--	152
Lead	10.2	1,000 [i]	250 [i]	270	118	50	50
Manganese	512	490,000	11,200	65.3	1,500	1,100 [h]	512
Mercury (inorganic)	0.33	1,050	24	2.09	5.5	0.1	0.33
Molybdenum	--	17,500	400	32.3	7	2	2
Nickel	19.1	70,000	1,600	130	980	30	30
Selenium	0.78 [j]	17,500	400	5.2	0.3	1	0.78
Silver	0.73	17,500	400	13.6	--	2	2

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)
Strontium	--	Unlimited [k]	48,000	2,920	--	--	2,920
Sulfide	--	--	--	--	--	--	--
Thallium	--	245	5.6	1.59	--	1	1
Uranium	3.21 [l]	10,500	240	1.32	--	5	3.21
Vanadium	85.1	24,500	560	2,240	--		560
Zinc	67.8	Unlimited [k]	24,000	5,970	360	86 [h]	86
Chloride	100	--	--	1,000	--	--	1,000
Fluoride	2.81	210,000	4,800	5.78	--	200	5.78
Nitrate (as nitrogen)	52 [m]	Unlimited [k]	128,000	40	--	--	40
Nitrite	--	350,000	8,000	4	--	--	4
Nitrogen in nitrite and nitrate	12 [n]	--	--	--	--	--	12
Sulfate	237	--	--	1,000	--	--	1,000
Organics							
Acenaphthene	--	210,000	4,800	121	--	20	20
Acenaphthylene	--	210,000	4,800	97.9	--	--	97.9
Acetone	--	Unlimited [k]	72,000	28.9	--	--	28.9
Acetate							
Acetonitrile	--	21,000	480	0.196	--	--	0.196
Acrylic acid	--	Unlimited [k]	40,000	--	--	--	40,000
Anthracene	--	Unlimited [k]	24,000	1,140	--	--	1,140
Benzo(a)anthracene	--	180	1.37	0.856	--	--	0.856
Benzo(a)pyrene	--	18	0.137	0.232	12	--	0.137
Benzo(b)fluoranthene	--	180	1.37	2.95	--	--	1.37

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)
Benzo(ghi)perylene	--	105,000	2,400	25,700	--	--	2,400
Benzo(k)fluoranthene	--	1,800	13.7	29.5	--	--	13.7
Benzyl alcohol	--	Unlimited [k]	24,000	20.7	--	--	20.7
Bis(2-ethylhexyl) phthalate	--	9,380	71.4	13.9	--	--	13.9
2-Butanone (MEK)	--	Unlimited [k]	48,000	19.6	--	--	19.6
Bromodichloromethane	--	2,120	16.1	0.00368	--	--	0.00368
Carbon disulfide	--	350,000	8,000	5.65	--	--	5.65
2-Chlorophenol	--	17,500	400	0.943	--	--	0.943
Chrysene	--	18,000	137	95.6	--	--	95.6
Dibenzo(ah)anthracene	--	18	0.137	0.429	--	--	0.137
Dibutylphosphate	--	--	--	--	--	--	--
Di-n-butylphthalate	--	350,000	8,000	56.5	--	200	56.5
p-Dichlorobenzene	--	5,470	41.7	0.03	---	20	0.03
Fluorene	--	140,000	3,200	101	--	30	30
Formate (formic acid)	--	Unlimited [k]	160,000	--	--	--	160,000
Glycolate (glycolic acid)	--	--	--	--	--	--	--
Hexane	--	210,000	4,800	96.2	--	--	96.2
Indeno(123-cd)pyrene	--	180	1.37	8.33	--	--	1.37
Kerosene	--	2,000 [g]	2,000 [g]	2,000 [g]	5,000	--	2,000
Methylene Chloride	--	17,500	133	0.0218	--	--	0.0218
Monobutylphosphate	--	--	--	--	--	--	--
Oxalate (oxalic acid)	--	--	--	--	--	--	--

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)
Phenanthrene (ethanedionic acid)	--	Unlimited [k]	24,000	1,140	--	--	1,140
Phenol	--	Unlimited [k]	24,000	22	--	30	22
Pyrene	--	105,000	2,400	655	--	--	655
Tetrachloroethene (PCE)	--	243	1.85	0.000859	--	--	0.000859
Toluene	--	28,000	6,400	4.65	--	200	4.65
Tributyl phosphate	--	24,300	185	6.18	--	--	6.18
1,1,1-Trichloroethane	--	Unlimited [k]	72,000	1.58	--	--	1.58
1,1,2,2-Tetrachloroethane	--	656	5	0.00123	--	--	0.00123
1,1,2-Trichloro-1,2,2-trifluoroethane	--	Unlimited [k]	Unlimited [k]	22,000	--	--	22,000
1,1,2-Trichloroethane	--	2,300	17.5	0.00427	--	--	0.00427
1,2,4-Trichlorobenzene	--	35,000	800	2.98	--	20	2.98
1,2,4-Trimethylbenzene	--	175,000 [g]	4,000 [g]	--	--	--	4,000
o-Dichlorobenzene	--	315,000	7,200	7.03	--	--	7.03
1,1-Dichloroethane	--	350,000	8,000	4.37	--	--	4.37
1,2-Dichloroethane	--	1,444	11	0.00232	--	--	0.00232
1,1-Dichloroethene	--	219	1.67	0.000522	--	--	0.000522
1-butanol	--	350,000	8,000	6.62	--	--	6.62
2,4,5-Trichlorophenol	--	350,000	8,000	57.5	--	4	4
2,4,6-Trichlorophenol	--	11,900	90.0	0.0924	--	10	0.0924
2,4-Dinitrotoluene	--	7,000	160	0.189	--	--	0.189
2,6-Bis(tert-butyl)-4-methylphenol	--	--	--	--	--	--	--
2-Ethoxyethanol	--	Unlimited [k]	32,000	25.7	--	--	25.7

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)
3-Methylphenol (m-cresol, m-cresylic acid)	--	175,000	4,000	10.1	--	--	10.1
2-Methylphenol (o-cresol, o-cresylic acid)	--	175,000	4,000	10.3	--	--	10.3
4-Methylphenol (p-cresol, p-cresylic acid)	--	17,500	400	1.01	--	--	1.01
o-Nitrophenol	--	--	--	--	--	--	--
2-Nitropropane	--	13.8	0.105	0.0000208	--	--	0.0000208
p-Chloro-m-cresol (4-Chloro-3-methylphenol)	--	175,000	4,000	--	--	--	4,000
4-Methyl-2-pentanone (MIBK)	--	280,000	6,400	2.71	--	--	2.71
Aroclor-1016 [p]	--	245	5.6	2.41	0.65 [q]	40 [q]	0.65 [p]
Aroclor-1221 [p]	--	65.6	0.5	0.092	0.65 [q]	40 [q]	0.092
Aroclor-1232 [p]	--	65.6	0.5	0.092	0.65 [q]	40 [q]	0.092
Aroclor-1242 [p]	--	65.6	0.5	0.394	0.65 [q]	40 [q]	0.394
Aroclor-1248 [p]	--	65.6	0.5	0.386	0.65 [q]	40 [q]	0.386
Aroclor-1254 [p]	--	65.6	0.5	0.066	0.65 [q]	40 [q]	0.066
Aroclor-1260 [p]	--	65.6	0.5	0.72	0.65 [q]	40 [q]	0.5
Benzene	--	2,390	18.2	0.00448	--	--	0.00448
Butylbenzylphthalate	--	700,000	16,000	893	--	--	893
Carbon Tetrachloride	--	1,010	7.69	0.00310	--	--	0.00310
Chlorobenzene	--	70,000	1,600	0.874	--	40	0.874
Chloroform	--	21,500	164	0.0381	--	--	0.0381

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)
Cresylic acid (cresol, mixed isomers)	--	--	--	--	--	--	--
Cyclohexanone	--	Unlimited [k]	400,000	344	--	--	344
Di-n-octylphthalate	--	3,500	80	0.524	--	--	0.524
Ethyl Acetate	--	Unlimited [k]	72,000	59.5	--	--	59.5
Ethylbenzene	--	350,000	8,000	6.05	--	--	6.05
Ethyl ether	--	70,000	16,000	6.68	--	--	6.68
Fluoranthene	--	140,000	3,200	631	--	--	631
Hexachlorobutadiene	--	700	12.8	0.605	--	--	0.605
Hexachloroethane	--	3,500	71.4	0.125	--	--	0.125
Isobutanol	--	Unlimited [k]	24,000	19.4	--	--	19.4
m-Xylene	--	Unlimited [k]	160,000	84.4	--	--	84.4
Naphthalene	--	70,000	1,600	4.46	--	--	4.46
Nitrobenzene	--	1,750	40	0.026	--	40	0.026
n-nitroso-di-n-propylamine	--	18.8	0.143	0.000056	--	--	0.000056
n-nitrosomethyl amine	--	2.57	0.0196	0.00000817	--	--	--
n-nitrosomethylethyl amine	--	5.97	0.0455	--	--	--	0.0455
n-Nitrosomorpholine	--	--	--	--	--	--	--
o-Xylene	--	Unlimited [k]	160,000	91.9	--	--	91.9
p-Xylene	--	--	--	172	--	--	172
Pyridine	--	3,500	80	0.0746	--	--	0.0746
1,3-dichloropropene	--	729	5.56	0.00141	--	--	0.00141
1,1,2-Trichloroethylene	--	11,900	90.9	0.0263	--	--	0.0263

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)
Trichlorofluoromethane	--	Unlimited [k]	24,000	28.4	--	--	28.4
Chloroethene (vinyl chloride)	--	87.5	0.667	0.000184	--	--	0.000184
Xylenes	--	700,000	16,000	14.6	--	--	14.6
Cis/trans-1,2-dichloroethylene	--	31,500	720	--	--	--	720
Tetrahydrofuran	--	3,500 [g]	80 [g]	0.05 [g]	--	--	0.05 [g]
Total petroleum hydrocarbon-gasoline range w/benzene	--	30	30	30	5,000 [r]	100	30
Total petroleum hydrocarbon-diesel range	--	2,000	2,000	2,000	6,000 [s]	200	200
Hydraulic fluids (greases)	--	2,000	2,000	2,000	--	--	2,000

[a] Unless otherwise noted, values from DOE/RL-92-24, *Hanford Site Background; Part 1, Soil Background for Nonradioactive Analytes*, Vol. 1, Rev. 4, Table 6-9a, lognormal distribution 90%.

[b] Unless otherwise noted, values from Ecology 94-145, *Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulation; CLARC, Version 3.1* tables (CLARC value calculations on January 25, 2006).

[c] Unless otherwise noted, values from WAC 173-340-900, "Tables," Table 749-3.

[d] Values listed represent the most restrictive soil cleanup level. This process takes the most conservative value derived from the evaluation of direct exposure, groundwater, and terrestrial wildlife protection and evaluates this value to ensure that it is not less than natural background and analytical considerations, as indicated in WAC 173-340-700(6)(d), "Overview of Cleanup Standards," "Requirements for Setting Cleanup Levels," "Natural Background and Analytical Considerations." Values represented are for screening purposes. Site-specific evaluation and modeling will be performed to determine if remedial actions are protective of human health and the environment.

[e] Value same as DOE/RL-92-24, Table 6-9a, lognormal distribution 90% for ammonia, because both ammonia and the ammonium ion are based on measurement of nitrogen.

[f] Value from Table 7 of Ecology 94-115, *Natural Background Soil Metals Concentrations in Washington State.*

[g] Values from DOE/RL-2004-39, *200-UR-1 Unplanned Release Waste Group Operable Unit Remedial Investigation/Feasibility Study Work Plan and Engineering Evaluation/Cost Analysis*, Table B-5.

[h] Values from WAC 173-340-900, Table 749-3, with note "benchmark replaced by Washington State natural background concentration".

[i] Reported Method A values from Ecology 94-145 tables (CLARC value calculations on January 25, 2006).

[j] Value from Figure 47 of Ecology 94-115, *Natural Background Soil Metals Concentrations in Washington State.*

Table 3-5b. Comparison of Inorganic and Organic Constituent Preliminary Cleanup Levels For All Pathways. (8 Pages)

Analyte	Hanford Site Background [a] (mg/kg)	Industrial Land-Use Scenario, Method C, Direct Contact [b] (mg/kg)	Unrestricted Land-Use Scenario, Method B, Direct Contact [b] (mg/kg)	Groundwater Protection [b], Method B (mg/kg)	Terrestrial Wildlife Protection [c], Table 749-3 (mg/kg)	Plants or Soil Biota [c], Table 749-3 (mg/kg)	Lowest Overall CUL [d] or Background (mg/kg)

[k] Unlimited indicates that the value is greater than 1 million parts per million.
[l] Based on the combined background value for the specific isotopes found in DOE/RL-96-12, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, Table 5-1, lognormal distribution 90%.
[m] Value applies to analytical results where measured nitrogen content has been calculated and reported as nitrate.
[n] Based on DOE/RL-92-24, Table 6-9a, lognormal distribution 90% value for nitrate, reported in terms of nitrogen in nitrate and nitrite. The anion form of nitrogen typically is found in the Hanford Site soils as nitrate.
[o] Inhalation hazard only, according to the Ecology 94-145 tables (CLARC value calculations on January 25, 2006).
[p] The use of congeners and detection limits for analysis of samples in this DQO (EPA Method 8082 vs 1668 in SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, as amended) is an unresolved technical issue. The path forward on this issue is a tiered approach with Aroclor analysis serving as a screen. Only when Aroclors are present at a mutually agreed-to threshold concentration would congener analysis proceed.
[q] Value is for total polychlorinated biphenyl mixture
[r] Values from WAC 173-340-900, Table 749-3, with note "5,000 mg/kg except that the concentration shall not exceed residual saturation at the soil surface."
[s] Values from WAC 173-340-900, Table 749-3, with note "6,000 mg/kg except that the concentration shall not exceed residual saturation at the soil surface."
"—" no information available.
Aroclor is an expired trademark.
CUL = cleanup level.

Table 3-6a. Facilities Process-Waste Pipeline Systems – Radionuclide Analytical Performance Requirements. (2 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits [a] (pCi/g)	Precision Required (%) [b]	Accuracy Required (%) [b]
14596-10-2	Americium-241	Am-241 AEA	31.1	1	±30	70-130
14762-75-5	Carbon-14	C-14 LSC (low level)	4.65	1	±30	70-130
10045-97-3	Cesium-137	Gamma GS	6.2	0.1	±30	70-130
10198-40-0	Cobalt-60	Gamma GS	1.4	0.05	±30	70-130
14683-23-9	Europium-152	Gamma GS	3.3	0.1	±30	70-130
15585-10-1	Europium-154	Gamma GS	3.0	0.1	±30	70-130

Table 3-6a. Facilities Process-Waste Pipeline Systems – Radionuclide Analytical Performance Requirements. (2 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits [a] (pCi/g)	Precision Required (%) [b]	Accuracy Required (%) [b]
14391-16-3	Europium-155	Gamma GS	125	0.1	±30	70-130
13994-20-2	Neptunium-237	Np-237 AEA	2.5	1	±30	70-130
13981-37-8	Nickel-63	Ni-63 LSC	4,026	30	±30	70-130
14681-63-1	Niobium-94 [c]	Gamma GS	2.43	1	±30	70-130
13981-16-3	Plutonium-238	AEA	37.4	1	±30	70-130
Pu-239/240	Plutonium-239/240	AEA	33.9	1	±30	70-130
13982-63-3	Radium-226	Gamma GS	7.03	0.2	±30	70-130
Rad-Sr	Strontium-90	Strontium-89,90 - Total Sr – gas proportional counting	4.5	1	±30	70-130
14133-76-7	Technetium-99	Technetium-99 LSC (low level)	1.93	1	±30	70-130
10028-17-8	Tritium	Tritium - H_3 LSC (mid level)	48.2	30	±30	70-130
13966-29-5	Uranium-233/234	Isotopic Uranium AEA	1.1	1	±30	70-130
15117-96-1	Uranium-235		101	1	±30	70-130
U-238	Uranium-238		1.06	1	±30	70-130
N/A	Gross cesium-137 counts	Portable NaI detector		3.1	N/A	N/A
N/A	Gross alpha	Portable contamination detector		100 d/min/ 100 cm^2	N/A	N/A
N/A	Gross beta/gamma	Portable contamination detector		5,000 d/min/ 100 cm^2	N/A	N/A

[a] Units are in pCi/g (radioisotopes) unless otherwise specified.

[b] Accuracy criteria for associated batch laboratory control sample percent recoveries. With the exception of gamma energy analysis, additional analysis-specific evaluations also performed for matrix spikes, tracers, and carriers, as appropriate to the method. Precision criteria are based on batch laboratory replicate sample analyses.

[c] Contaminant of potential concern analysis only applicable to Plutonium Finishing Plant Area.

AEA = alpha energy analysis.
CUL = cleanup level.
GS = gamma spectroscopy.
LSC = liquid scintillation counter.
N/A = not applicable.
NaI = sodium iodide.

Table 3-6b. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (5 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
Inorganics						
7440-36-0	Antimony	EPA Methods 6010 (trace), 6020, or 200.8 (trace)	5	0.6	±30	70-130
7440-38-2	Arsenic	EPA Methods 6010 (trace), 6020, or 200.8	6.47	1	±30	70-130
7440-39-3	Barium	EPA Methods 6010, 6020, or 200.8	132	20	±30	70-130
7440-41-7	Beryllium	EPA Methods 6010, 6020, or 200.8	10	0.5	±30	70-130
7440-43-9	Cadmium	EPA Methods 6010, 6020, or 200.8	0.81	0.5	±30	70-130
7440-47-3	Chromium (III)/Chromium (total)	EPA Methods 6010, 6020, or 200.8	42	1	±30	70-130
7440-50-8	Copper	EPA Methods 6010, 6020, or 200.8	50	1	±30	70-130
18540-29-9	Hexavalent chromium	EPA Method 7196	18.4 [d]	0.5	±30	70-130
7439-92-1	Lead	EPA Methods 6010, 6020, or 200.8	50	5	±30	70-130
7439-97-6	Mercury	EPA Methods 7471, 6020, or 200.8	0.33	0.2	±30	70-130
7439-98-7	Molybdenum	EPA Methods 6010, 6020, or 200.8	2	2	±30	70-130
7440-02-0	Nickel	EPA Methods 6010, 6020, or 200.8	30	4	±30	70-130
7782-49-2	Selenium	EPA Methods 6010 (trace), 6020, or 200.8	0.78	1 [e]	±30	70-130
14808-79-8	Sulfate	IC Anions 300.0	1,000	5	±30	70-130
7440-22-4	Silver	EPA Methods 6010, 6020, or 200.8	2	2	±30	70-130
7440-28-0	Thallium	EPA Methods 6010 (trace), 6020, or 200.8	1	0.5	±30	70-130
7440-61-1	Uranium (total)	Kinetic phosphorescence analysis, or EPA Method 200.8	3.21	0.2	±30	70-130

Table 3-6b. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (5 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
7440-62-2	Vanadium	EPA Methods 6010, 6020, or 200.8	560	2.5	±30	70-130
7440-66-6	Zinc	EPA Methods 6010, 6020, or 200.8	86	1	±30	70-130
57-12-5	Cyanide	EPA Methods 9010 total cyanide or 335	0.80	0.5	±30	70-130
14797-55-8	Nitrate	IC, EPA Method 300.0	40	2.5	±30	70-130
14797-65-0	Nitrite	IC, EPA Method 300.0	4	2.5	±30	70-130
NO_3/NO_2	Nitrogen in nitrite and nitrate	EPA Method 353	12	0.75	±30	70-130
		Organics				
208-96-8	Acenaphthylene	EPA Method 8270	97.9	0.33	±30	70-130
67-64-1	Acetone	EPA Method 8260	28.9	0.02	±30	70-130
75-05-8	Acetonitrile	EPA Method 8260	0.196	0.1	±30	70-130
71-43-2	Benzene	EPA Method 8260	0.00448	0.0015	±30	70-130
120-12-7	Anthracene	EPA Method 8270	1,140	0.33	±30	70-130
56-55-3	Benzo(a)anthracene	EPA Method 8270	0.856	0.33	±30	70-130
50-32-8	Benzo(a)pyrene	EPA Method 8270	0.137	0.33	±30	70-130
205-99-2	Benzo(b)fluoranthene	EPA Method 8270	1.37	0.33	±30	70-130
191-24-2	Benzo(ghi)perylene	EPA Method 8270	2,400	0.33	±30	70-130
207-08-9	Benzo(k)fluoranthene	EPA Method 8270	13.7	0.33	±30	70-130
100-51-6	Benzyl alcohol	EPA Method 8260/8270	20.7	0.33	±30	70-130
75-27-4	Bromodichloromethane	EPA Method 8260	0.00368	0.005	±30	70-130
71-36-3	n-butyl alcohol (1-butanol)	EPA Method 8015or 8260	6.62	5	±30	70-130
56-23-5	Carbon tetrachloride	EPA Method 8260	0.00310	0.002	±30	70-130
108-90-7	Chlorobenzene	EPA Method 8260	0.874	0.005	±30	70-130

Table 3-6b. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (5 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
67-66-3	Chloroform (trichloro-methane)	EPA Method 8260	0.0381	0.005	±30	70-130
218-01-9	Chrysene	EPA Method 8270	95.6	0.33	±30	70-130
156-59-2/ 156-60-5	Cis/Trans-1,2-Dichloro-ethylene	EPA Method 8260	720	0.005	±30	70-130
108-94-1	Cyclohexanone	EPA Method 8270	344	0.5	N/A	N/A
53-70-3	Dibenzo(ah)anthracene	EPA Method 8270	0.137	0.33	±30	70-130
75-34-3	1,1-Dichloroethane	EPA Method 8260	4.37	0.001	±30	70-130
107-06-2	1,2-Dichloroethane	EPA Method 8260	0.00232	0.002	±30	70-130
75-35-4	1,1-Dichloroethylene	EPA Method 8260	0.000522	0.002	±30	70-130
75-09-2	Dichloromethane (methylene chloride)	EPA Method 8260	0.0218	0.005	±30	70-130
106-46-7	p-Dichlorobenzene	EPA Method 8270	0.03	0.33	±30	70-130
107-66-4	Dibutylphosphate	TBD	--	TBD		
100-41-4	Ethyl benzene	EPA Method 8260	6.05	0.005	±30	70-130
60-29-7	Ethyl ether	EPA Method 8015	6.68	5	±30	70-130
86-73-7	Fluorene	EPA Method 8270	30	0.33	±30	70-130
64-18-6	Formate (formic acid)	EPA Method 300.0	--	10.0	±30	70-130
79-14-1	Glycolate (glycolic acid)	TBD	--	TBD		
110-54-3	Hexane	EPA Method 8260	96.2	TBD	±30	70-130
193-39-5	Indeno(123-cd)pyrene	EPA Method 8270	1.37	0.33	±30	70-130
108-10-1	Methyl isobutyl ketone (MIBK hexone)	EPA Method 8260	2.71	0.01	±30	70-130
78-93-3	Methyl ethyl ketone (MEK)	EPA Method 8260	19.6	0.01	±30	70-130
--	Monobutylphosphate	TBD	--	TBD		

Table 3-6b. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (5 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
144-62-7	Oxalate (oxalic acid)	EPA Method 300.0	--	TBD		
127-18-4	Perchloroethylene (tetrachloro-ethene, PCE)	EPA Method 8260	0.000859	0.005	±30	70-130
88-01-8	Phenanthrene (ethanedionic acid)	EPA Method 8270	1,140	0.33	±30	70-130
108-95-2	Phenol	EPA Method 8270	22	0.33	±30	70-130
95-63-6	Pseudocumene (1,2,4-trimethyl benzene)	EPA Method 8260	4,000	0.2	±30	70-130
109-99-9	Tetrahydrofuran	EPA Method 8260	0.05	0.05	±30	70-130
108-88-3	Toluene	EPA Method 8260	4.65	0.005	±30	70-130
71-55-6	1,1,1-Trichloroethane (TCA)	EPA Method 8260	1.58	0.005	±30	70-130
79-00-5	1,1,2-Trichloroethane	EPA Method 8260	0.00427	0.002	±30	70-130
79-01-6	Trichloroethylene (TCE)	EPA Method 8260	0.0263	0.005	±30	70-130
75-01-04	Vinyl chloride	EPA Method 8260	0.000184	0.01	±30	70-130
1330-20-7	Xylenes	EPA Method 8260	14.6	0.01	±30	70-130
126-73-8	Tributyl phosphate	EPA Method 8270	6.18	3.3	±30	70-130
2674-11-2	Aroclor 1016	PCBs, EPA Method 8082	0.65	0.02	±30	70-130
11104-26-2	Aroclor 1221	PCBs, EPA Method 8082	0.092	0.02	±30	70-130
11141-16-5	Aroclor 1232	PCBs, EPA Method 8082	0.092	0.02	±30	70-130
53969-21-9	Aroclor 1242	PCBs, EPA Method 8082	0.394	0.02	±30	70-130
126572-29-6	Aroclor 1248	PCBs, EPA Method 8082	0.386	0.02	±30	70-130
11097-6999-1	Aroclor 1254	PCBs, EPA Method 8082	0.066	0.02	±30	70-130
11096-82-5	Aroclor 1260	PCBs, EPA Method 8082	0.5	0.02	±30	70-130

Table 3-6b. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (5 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
TPH gasoline	Total petroleum hydrocarbon-gasoline range w/benzene	NWTPH gasoline	30	5	±30	70-130
TPH diesel	Total petroleum hydrocarbon-diesel range	NWTPH diesel	200	5	±30	70-130
Oil/grease	Hydraulic fluids (greases)	EPA Method 413.1 oil/grease or 1664A	2,000	200	±30	70-130
8008-20-6, TPH-kerosene	Kerosene, normal paraffins, paint thinner	NWTPH-Dx modified for kerosene range	2,000	5	±30	70-130

[a] For 4-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, as amended. For EPA Methods 300.0, 335, 353, and 413.1, see EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes*. For EPA Method 200.8, see EPA/600/4-91/010, *Methods for the Determination of Metals in Environmental Samples*. For NWTPH Methods, see Ecology 97-602, *Analytical Methods for Petroleum Hydrocarbons*.

[b] Detection limits are based on optimal conditions in a standard fixed laboratory. Interferences and matrix effects may degrade the values shown.

[c] Accuracy criteria is the minimum for associated batch laboratory control sample percent recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also are performed for matrix spikes and surrogates, as appropriate to the method. Precision criteria are based on batch laboratory replicate matrix spike analyses.

[d] Target detection limit is less than the inhalation limit of 2 mg/kg.

[e] Special arrangements will be made with the laboratory to achieve the detection limit needed for the ecological action level for selenium.

"--" No information available.

CUL = cleanup level.
EPA = U.S. Environmental Protection Agency.
IC = ion chromatography.
N/A = not applicable.
NWTPH = Northwest total petroleum hydrocarbon.
PCB = polychlorinated biphenyl.
TBD = to be determined; method and/or detection limit currently are under evaluation.

Table 3-7a. Tank Farms Process-Waste Pipeline Systems – Radionuclides Analytical Performance Requirements. (2 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits [a] (pCi/g)	Precision Required (%) [b]	Accuracy Required (%) [b]
14234-35-6	Antimony-125	Gamma GS	--	0.3	±30	70-130
14596-10-2	Americium-241	Am-241 AEA	31.1	1	±30	70-130
14762-75-5	Carbon-14	C-14 LSC (low level)	4.65	1	±30	70-130
10045-97-3	Cesium-137	Gamma GS	6.2	0.1	±30	70-130
10198-40-0	Cobalt-60	Gamma GS	1.4	0.05	±30	70-130
15510-73-3	Curium-242	Am-241/Cu-244 AEA	--	1.0	±30	70-130
15757-87-6	Curium-243 [c]	Am-241/Cu-244 AEA	110	1.0	±30	70-130
13981-15-2	Curium-244 [c]	Am-241/Cu-244 AEA	744	1.0	±30	70-130
14683-23-9	Europium-152	Gamma GS	3.3	0.1	±30	70-130
15585-10-1	Europium-154	Gamma GS	3.0	0.1	±30	70-130
14391-16-3	Europium-155	Gamma GS	125	0.1	±30	70-130
15046-84-1	Iodine 129	Iodine-129-LSC	0.12	2	±30	70-130
13994-20-2	Neptunium-237	Np-237 AEA	2.5	1	±30	70-130
13981-37-8	Nickel-63	Ni-63 LSC	4,026	30	±30	70-130
13981-16-3	Plutonium-238	AEA	37.4	1	±30	70-130
Pu-239/240	Plutonium-239/240	AEA	33.9	1	±30	70-130
13982-63-3	Radium-226	Gamma GS	7.03	0.2	±30	70-130
15758-85-9	Selenium-79	Selenium-79-LSC	197,000	10	±30	70-130
Rad-Sr	Strontium-90	Strontium-89,90 - Total Sr - Gas Proportional Counting	4.5	1	±30	70-130
14133-76-7	Technetium-99	Technetium-99 LSC (low level)	1.93	1	±30	70-130
14274-82-9	Thorium 228	Isotopic Thorium AEA	7.73	1	±30	70-130

Table 3-7a. Tank Farms Process-Waste Pipeline Systems – Radionuclides Analytical Performance Requirements. (2 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits [a] (pCi/g)	Precision Required (%) [b]	Accuracy Required (%) [b]
14269-63-7	Thorium 230	Isotopic Thorium AEA	20.1	1	±30	70-130
TH-232	Thorium 232		4.8	1	±30	70-130
10028-17-8	Tritium	Tritium – H-3 LSC(mid level)	48.2	30	±30	70-130
15832-50-5	Tin 126	GEA	TBD	TBD	±30	70-130
13966-29-5	Uranium-233/234	Isotopic Uranium AEA	1.1	1	±30	70-130
15117-96-1	Uranium-235/236		101	1	±30	70-130
U-238	Uranium-238		1.06	1	±30	70-130
N/A	Gross cesium-137 counts	Portable NaI detector		3.1	N/A	N/A
N/A	Gross alpha	Portable contamination detector		100 d/min/ 100 cm^2	N/A	N/A
N/A	Gross beta/gamma	Portable contamination detector		5,000 d/min/ 100 cm^2	N/A	N/A

[a] Units are in pCi/g (radioisotopes) unless otherwise specified.

[b] Accuracy criteria for associated batch laboratory control sample percent recoveries with the exception of GEA, additional analysis-specific evaluations also performed for matrix spikes, tracers, and carriers, as appropriate to the method. Precision criteria are based on batch laboratory replicate sample analyses.

[c] Curium-243 cannot be separated or quantified separately from curium-244.

AEA = alpha energy analysis.
CUL = cleanup level.
GEA = gamma energy analysis.
GS = gamma spectroscopy.
ICP/MS = inductively coupled plasma/mass spectrometry.
LSC = liquid scintillation counter.
N/A = not applicable.
NaI = sodium iodide.
TBD = to be determined.

Table 3-7b. Tank Farms Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (6 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
		Inorganics				
7429-90-5	Aluminum	EPA Method 6010	45.2	5	±30	70-130
7440-36-0	Antimony	EPA Methods 6010, 6020, or 200.8 (trace)	5	0.6	±30	70-130
7440-38-2	Arsenic	EPA Methods 6010, 6020, or 200.8	6.5	1	±30	70-130
7440-39-3	Barium	EPA Methods 6010, 6020, or 200.8	132	20	±30	70-130
7440-41-7	Beryllium	EPA Methods 6010, 6020, or 200.8	10	0.5	±30	70-130
7440-43-9	Cadmium	EPA Methods 6010, 6020, or 200.8	0.81	0.5	±30	70-130
7440-47-3	Chromium (III)/ Chromium (total)	EPA Methods 6010, 6020, or 200.8	42	1	±30	70-130
7440-48-4	Cobalt	EPA Methods 6010, 6020, or 200.8	20	2	±30	70-130
7440-50-8	Copper	EPA Methods 6010, 6020, or 200.8	50	1	±30	70-130
18540-29-9	Hexavalent chromium	EPA Method 7196	18.4	0.5	±30	70-130
7439-89-6	Iron	EPA Methods 6010, 6020, or 200.8	152	5	±30	70-130
7439-92-1	Lead	EPA Methods 6010, 6020, or 200.8	50	5	±30	70-130
7439-96-5	Manganese	EPA Methods 6010, 6020, or 200.8	512		±30	70-130
7439-97-6	Mercury	EPA Methods, 7471, 6020, or 200.8	0.33	0.2	±30	70-130
7440-02-0	Nickel	EPA Methods 6010, 6020, or 200.8	30	4	±30	70-130
7782-49-2	Selenium	EPA Methods 6010, 6020, or 200.8	0.3	1 [d]	±30	70-130
7440-22-4	Silver	EPA Methods 6010, 6020, or 200.8	2	2	±30	70-130
7440-24-6	Strontium	EPA Methods 6010, 6020, or 200.8	2,920	1	±30	70-130
7440-28-0	Thallium	EPA Methods 6010, 6020, or 200.8	1	0.5	±30	70-130
7440-61-1	Uranium	EPA Methods 200.8, 6020, or kinetic phosphorescence absorption	3.21	1	±30	70-130

Table 3-7b. Tank Farms Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (6 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
7440-62-2	Vanadium	EPA Methods 6010, 6020, or 200.8	560	2.5	±30	70-130
7440-66-6	Zinc	EPA Methods 6010, 6020, or 200.8	86	1	±30	70-130
57-12-5	Cyanide (includes ferrocyanide)	EPA Methods 9010 total cyanide or 335	0.8	0.5	±30	70-130
16984-48-8	Fluoride	IC, EPA Method 300.0	5.78	5	±30	70-130
14797-55-8	Nitrate	IC, EPA Method 300.0	40	2.5	±30	70-130
14797-65-0	Nitrite	IC, EPA Method 300.0	4	2.5	±30	70-130
NO_3/NO_2	Nitrogen in nitrate/nitrite	EPA Method 353		0.75	±30	70-130
18496-25-8	Sulfide	EPA Method9030	--	5	±30	70-130
7664-41-7	Ammonia (NH_3)	EPA Method 350.1	9.23	0.5	±30	70-130
	Ammonium (NH_4)	EPA Method 300.7	9.23	0.5	±30	70-130
		Organics				
67-64-1	Acetone	EPA Method 8260	28.9	0.02	±30	70-130
	Acetate	EPA Method 9056	none	400	±30	70-130
79-10-7	Acrylic acid	TBD	40,000	TBD		
71-43-2	Benzene	EPA Method 8260	0.00448	0.0015	±30	70-130
106-99-0	1,3-Butadiene	EPA Method 8260	--[e]	TBD		
75-15-0	Carbon disulfide	EPA Method 8260	5.65	0.005	±30	70-130
56-23-5	Carbon tetrachloride	EPA Method 8260	0.00310	0.002	±30	70-130
108-90-7	Chlorobenzene	EPA Method 8260	0.874	0.005	±30	70-130
67-66-3	Chloroform (trichloromethane)	EPA Method 8260	0.0381	0.005	±30	70-130
108-94-1	Cyclohexanone	EPA Method 8270	344	0.5	N/A	N/A
107-06-2	1,2-Dichloroethane	EPA Method 8260	0.00232	0.002	±30	70-130

Table 3-7b. Tank Farms Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (6 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
75-35-4	1,1-Dichloroethylene	EPA Method 8260	0.000522	0.01	±30	70-130
75-09-2	Dichloromethane (methylene chloride)	EPA Method 8260	0.0218	0.002	±30	70-130
10061-02-6	Dichloropropene; 1,3,- (trans-)	EPA Method 8260	0.00141	0.005	±30	70-130
141-78-6	Ethyl acetate	EPA Method 8015	59.5	5	±30	70-130
60-29-7	Ethyl ether	EPA Method 8015, 8260	6.68	5	±30	70-130
100-41-4	Ethyl benzene	EPA Method 8260	6.05	0.005	±30	70-130
67-72-1	Hexachloroethane	EPA Method 8270	0.125	0.33	±30	70-130
108-10-1	Methyl isobutyl ketone (MIBK hexone)	EPA Method 8260	2.71	0.01	±30	70-130
78-93-3	Methyl ethyl ketone (MEK)	EPA Method 8260	19.6	0.01	±30	70-130
79-46-9	Nitropropane; 2-	TBD	0.0000208	TBD	±30	70-130
79-34-5	Tetrachloroethane; 1,1,2,2-	EPA Method 8260	0.00123	0.005	±30	70-130
127-18-4	Tetrachloroethene (PCE)	EPA Method 8260	0.000859	0.005	±30	70-130
108-88-3	Toluene	EPA Method 8260	4.65	0.005	±30	70-130
76-13-1	trichloro-1,2,2-trifluoroethane; 1,1,2-	EPA Method 8260	22,000	0.010	±30	70-130
71-55-6	1,1,1-Trichloroethane (TCA)	EPA Method 8260	1.58	0.005	±30	70-130
79-00-5	1,1,2-Trichloroethane	EPA Method 8260	0.00427	0.002	±30	70-130
83-32-9	Acenaphthene	EPA Method 8270	20	0.33	±30	70-130
117-81-7	Bis-2-ethylhexyl phthalate (Dioctylphthalate)	EPA Method 8270	13.9	0.33	±30	70-130
71-36-3	Butanol; n- (n-butyl alcohol)	EPA Method 8260, 8015	6.62	5	±30	70-130

Table 3-7b. Tank Farms Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (6 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
85-68-7	Butylbenzylphthalate	EPA Method 8270	893	0.33	±30	70-130
95-57-8	Chlorophenol; 2-	EPA Method 8270	0.943	0.33	±30	70-130
M + P CRESOL	Cresol; m + p (3/4-Methylphenol)	EPA Method 8270	10.1	0.33	±30	70-130
95-48-7	Cresol; o- (2-Methylphenol)	EPA Method 8270	10.3	0.33	±30	70-130
1319-77-3	Cresylic acid (cresol, mixed isomers)	EPA Method 8270	--	--	±30	70-130
84-74-2	Dibutylphthalate (Di-n-butylphthalate)	EPA Method 8270	56.5	0.33	±30	70-130
117-84-0	Di-n-octylphthalate	EPA Method 8270	0.524	0.33	±30	70-130
95-50-1	Dichlorobenzene; 1,2- (ortho-)	EPA Method 8270	7.03	0.33	±30	70-130
121-14-2	Dinitrotoluene; 2,4-	EPA Method 8270	0.189	0.33	±30	70-130
110-80-5	Ethoxyethanol; 2-	TBD	25.7	TBD	±30	70-130
206-44-0	Fluoranthene	EPA Method 8270	631	0.33	±30	70-130
87-68-3	Hexachlorobutadiene	EPA Method 8270	0.605	0.33	±30	70-130
78-83-1	Isobutyl alcohol (Isobutanol)	EPA Methods 8260 or 8015	19.4	5	±30	70-130
128-37-0	methylphenol; 2,6-Bis(tert-butyl)-4-	TBD	--	--	±30	70-130
59-50-7	methylphenol; 4-Chloro-3- (p-Chloro-m-cresol)	EPA Method 8270	4,000	0.33	±30	70-130
91-20-3	Naphthalene	EPA Method 8270	4.46	0.33	±30	70-130
98-95-3	Nitrobenzene	EPA Method 8270	0.026	0.33	±30	70-130
88-75-5	Nitrophenol; o-	EPA Method 8270	---	0.66	±30	70-130
621-64-7	Nitroso-di-n-propylamine; N-	EPA Method 8270	0.000056	0.33	±30	70-130

Table 3-7b. Tank Farms Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (6 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
	n-nitrosomethyl amine	TBD	--	TBD		
10595-95-6	n-nitrosomethylethyl amine	EPA Method 8270	0.0455	0.33	±30	70-130
79-01-6	Trichloroethylene (TCE)	EPA Method 8260	0.0263	0.005	±30	70-130
75-69-4	Trichlorofluoromethane	EPA Method 8260	28.4	0.01	±30	70-130
75-04-1	Vinyl chloride	EPA Method 8260	0.000184	0.01	±30	70-130
1330-20-7	Xylenes	EPA Method 8260	14.6	0.01	±30	70-130
108-38-3	Xylene; m-	TBD	84.4	--	±30	70-130
95-47-6	Xylene; o-	TBD	91.9	--	±30	70-130
106-42-3	Xylene; p-	TBD	172	--	±30	70-130
120-82-1	1,2,4 - Trichlorobenzene	EPA Method 8270	2.98	0.33	±30	70-130
59-89-2	Nitrosomorpholine; N-	EPA Method 8270	--	0.33	±30	70-130
129-00-0	Pyrene	EPA Method 8270	655	0.33	±30	70-130
110-86-1	Pyridine	EPA Method 8270	0.0746	0.66	±30	70-130
95-95-4	Trichlorophenol; 2,4,5-	EPA Method 8270	4	0.33	±30	70-130
88-06-2	Trichlorophenol; 2,4,6-	EPA Method 8270	0.0924	0.33	±30	70-130
		EPA Method 8041		0.165		
126-73-8	Tributyl phosphate	EPA Method 8270	6.18	3.3	±30	70-130
2674-11-2	Aroclor 1016	PCBs, EPA Method 8082	0.65	0.02	±30	70-130
11104-26-2	Aroclor 1221	PCBs, EPA Method 8082	0.092	0.02	±30	70-130
11141-16-5	Aroclor 1232	PCBs, EPA Method 8082	0.092	0.02	±30	70-130
53969-21-9	Aroclor 1242	PCBs, EPA Method 8082	0.394	0.02	±30	70-130
126572-29-6	Aroclor 1248	PCBs, EPA Method 8082	0.386	0.02	±30	70-130

Table 3-7b. Tank Farms Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (6 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method [a]	Lowest Overall CUL (mg/kg)	Target Detection Limits [b] (mg/kg)	Precision Required (%) [c]	Accuracy Required (%) [c]
11097-6999-1	Aroclor 1254	PCBs, EPA Method 8082	0.066	0.02	±30	70-130
11096-82-5	Aroclor 1260	PCBs, EPA Method 8082	0.5	0.02	±30	70-130

[a] For 4-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, as amended. For EPA Methods 300.0, 335, 350.1, and353, see EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes*. For EPA Method 200.8, see EPA/600/4-91/010, *Methods for the Determination of Metals in Environmental Samples*. For EPA Method 300.7, see EPA/600/4-86/024, *Development of Standard* Methods for the Collection and Analysis of Precipitation.

[b] Detection limits are based on optimal conditions in a standard fixed laboratory. Interferences and matrix effects may degrade the values shown.

[c] Accuracy criteria are the minimum for associated batch laboratory control sample percent recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also performed for matrix spikes and surrogates as appropriate to the method. Precision criteria are based on batch laboratory replicate matrix spike sample analyses

[d] Special arrangements will be made with the laboratory to achieve the detection limit needed for the ecological action level for selenium.

[e] Inhalation hazard only, according to the Ecology 94-145, *Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulation; CLARC, Version 3.1*, tables.

"--" No information available.

Aroclor is an expired trademark.

CUL = cleanup level.
EPA = U.S. Environmental Protection Agency.
IC = ion chromatography.
N/A = not applicable.
PCB = polychlorinated biphenyl.
TBD = to be determined.

4.0 STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

4.1 OBJECTIVE

The primary objective of DQO Step 4 is for the DQO team to identify the spatial, temporal, and practical constraints on the sampling design and to consider the consequences. This objective (in terms of the spatial, temporal, and practical constraints) ensures that the sampling design results in the collection of data that accurately reflect the true condition of the site and/or populations being studied.

4.2 DEFINE THE BOUNDARIES OF THE STUDY

Table 4-1 defines the population of interest to clarify what the samples are intended to represent. The characteristics that define the population of interest also are identified.

Table 4-1. Characteristics that Define the Population of Interest.

DS #	Population of Interest	Characteristics
1 and 3	Interior of process-waste pipeline systems	Concentrations of selected radionuclides, organic, and inorganic constituents for risk evaluation.
		Determination if transuranic [a] waste is present for waste designation.
2 and 4	Vadose zone soils	Concentrations of selected radionuclides, organic, and inorganic constituents for risk evaluation.
		Determination if transuranic [a] waste is present for waste designation.
5	Interior of process-waste pipeline systems	Concentrations of selected organic and inorganic constituents for risk evaluation
		Determination if dangerous waste [b] is present for waste designation.
Project Objectives 6,7, and 8 (From Step 1)	Vadose zone soils	Physical properties including moisture content, bulk density, and grain size distribution.

[a] Transuranic waste - is radioactive waste containing more than 100 nCi of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years except for (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the U.S. Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," disposal regulations; or (3) waste that the U.S. Nuclear Regulatory Commission has approved on a case-by-case basis in accordance with 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

[b] WAC 730-303, "Dangerous Waste Regulations."

DS = decision statement.

Table 4-2 defines the spatial boundaries of the decision and the domain or geographic area (or volume) within which all decisions must apply (in some cases, this may be defined by the OU). The domain is a region distinctly marked by some physical features (that is, volume, length, width, and boundary).

Table 4-2. Geographic Boundaries of the Investigation.

DS #	Geographic Boundaries of the Investigation
1 through 5	The geographic boundaries for the investigation are the boundaries of the process-waste pipeline system infrastructure, including any affected soils from the surface to groundwater.

DS = decision statement.

When appropriate, the population is divided into strata that have relatively homogeneous characteristics. The DQO team must systematically evaluate process knowledge and historical characterization data and present evidence of a logic that supports alignment of the population into strata with homogeneous characteristics. Table 4-3 identifies the strata with homogeneous characteristics.

Table 4-3. Zones with Homogeneous Characteristics.

DS #	Population of Interest	Zone	Homogeneous Characteristic Logic
1, 3, and 5	Residual contaminants within the interior of process-waste pipeline systems	Pipelines	Non-active pipelines assumed to be contaminated because of the process fluids that they transferred. However, the degree of contamination is not known.
1, 3, and 5	Residual contaminants within the interior of process-waste pipeline systems	Pipeline appurtenances (e.g., diversion boxes, catch tanks, valve pits, manholes, pumps, cleanout boxes, vents, sampling ports, elbows, concrete encasements)	Pipeline components that may contain higher contaminant concentrations.
1, 3, and 5	Residual contaminants within the interior of process-waste pipeline systems	Plugged pipelines	Pipelines known to be plugged and to contain residual contamination.
2 and 4	Vadose zone soils	Known release area	Unplanned releases associated with pipelines
2 and 4	Vadose zone soils	Suspect area	Areas of observed abnormalities (e.g., vegetation growth, ground subsidence, staining) coinciding with pipeline locations and areas adjacent to appurtenances.
2 and 4	Vadose zone soils	Unknown	Areas without known or suspect releases associated with pipelines

DS = decision statement.

The temporal boundaries of the investigation are defined in Table 4-4.

Table 4-4. Temporal Boundaries of the Investigation.

DS #	Time Frame	When to Collect Data
Field Screening		
1 through 5	Not applicable	No limitations.
Laboratory Samples		
1 through 5	Not applicable	No limitations

DS = decision statement.

4.3 SCALE OF DECISION MAKING

Table 4-5 defines the scale of decision-making for each DS. The scale of decision-making is defined as the smallest, most appropriate subsets of the population (subpopulation) for which decisions will be made based on the spatial or temporal boundaries of the area under investigation.

Table 4-5. Scale of Decision-Making.

DS #	Population of Interest	Geographic Boundary	Temporal Boundary		Spatial Scale of Decision-Making
			Time Frame	When to Collect Data	
1, 3, and 5	Residual contaminants within the interior of process-waste pipeline systems	Boundaries of the process-waste pipeline system infrastructure	Not applicable	No limitations	Pipelines
					Pipeline appurtenances
					Plugged pipelines
2 and 4	Vadose zone soils	Soils from ground surface to groundwater affected by the process-waste pipeline system infrastructure	Not applicable	No limitations	Known release area
					Suspect release area
					Unknown

DS = decision statement.

The zones with homogeneous characteristics in Table 4-3 identify strata within the process-waste pipeline system and in the surrounding vadose zone soils. However, the spatial scale of decision-making includes the entire facility and tank farm process-waste pipeline system (excludes region inside the WMAs, because they are not part of the 200-IS-1 OU) and surrounding vadose zone soils from the ground surface to the water table. The data supporting remedial decision-making will consider the distribution of contaminants within both the interior of pipeline systems and the surrounding vadose zone.

4.4 PRACTICAL CONSTRAINTS

Table 4-6 identifies all of the practical constraints that may impact the data collection effort. These constraints include physical barriers, difficult sample matrices, high radiation areas, or any other condition that will need to be taken into consideration to design and schedule of the sampling program.

Table 4-6. Practical Constraints on Data Collection. (2 Pages)

Constraint	Details
Physical Access	Placing driven soil probes, borings, or excavations near process-waste pipeline system structures (i.e., lines, diversion boxes, catch tanks) will pose additional access challenges because of the following: • Limited access to some locations because of surface obstructions (concrete pads, buildings, or roads built over lines, overhead electrical lines) • Subsurface obstructions (piping networks, soil matrix, structures) • Conflicts with adjacent administrative or operational boundaries • Limited equipment staging areas • Culturally sensitive areas. Access to the interior of pipelines for visual inspection, radiological instrument measurement, and sample collection may be constrained because of the following: • Very few locations such as manholes or aboveground pipe connections permitting direct access.
Methods	The methods selected for investigations, such as excavations (e.g., trenching or test pits), driven soil probes, or borings, will influence the following: • Driven point probe sampling, which may not obtain sufficient volumes of sample media if the sampling zone contains gravelly rather than sandy zone • Borehole drilling methods, which may be constrained to cable tool method. For example, no mud rotary because of liquid addition to sample matrix, no air rotary because of dilution of volatile organic compounds in samples and potential creation of airborne contamination. Cable tool drilling provides effective contamination control and least disturbed samples • Borehole split-tube sampling, which may not obtain sufficient volumes of sample media if the sampled zone is 0.6 m (2 ft) thick or less • Advancement of borehole casing, which may smear radiological contamination downhole so that contract laboratory radionuclide detection limits may not be obtained. Similar problems would be expected for high-concentration nonradioactive sample results.
Radiological Controls	Radiological issues that could influence the ability to perform the work involve the following: • Handling contaminated samples (high or very high radiation).

Table 4-6. Practical Constraints on Data Collection. (2 Pages)

Constraint	Details
Field Screening Techniques	The ability of field screening to meet quality assurance/quality control or detection requirements may be limited as follows: • Gross gamma logging in soils may be limited by background radiation levels from adjacent structures (e.g., pipelines, diversion boxes) • Passive neutron logging may be limited because of lower than expected quantities of neutron-emitting isotopes • Soil matrix characteristics (e.g., gravels) may limit use of those chemical field screen techniques that require fine-grained homogenous materials (e.g., X-ray fluorescence, immunoassay, colorimetric methods).
Analytical Laboratory Capabilities	Radiological controls and constraints at the sampling location may delay delivery of the samples to the laboratory, causing exceedance of hold-time limits. Prior planning will be used to minimize the potential for hold-time exceedance. The laboratory will strive to meet the applicable SW-846 hold times. Therefore, sample handling, preparation, and analysis will be performed with this goal in mind. If a holding time cannot be met, the laboratory will perform the analysis as soon as possible. The ability of laboratories to meet quality assurance/quality control requirements (e.g., holding times, detection limits) for some contaminants of potential concern (for example, volatile organic compounds and semivolatile organic compounds), and, therefore, to provide valid analytical results, is limited by requirements for handling highly radioactive samples. Laboratory constraints are expected when analyzing soil samples with high contaminant concentrations (nonradioactive or radioactive). Analyses may require dilution of samples to run the instrumentation. Soil samples in the highly radioactive category would be analyzed in an onsite laboratory. Impacts are expected in cost, degradation of detection limits, and possible reduction in the analyte lists. Given the uncertainty of the sample concentrations and dose, a significant effort will be required to coordinate sampling activities. The sampling and analysis plan will include coordination efforts and details to guide selection of analytical laboratory.

SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, as amended

This page intentionally left blank.

5.0 STEP 5 – DEVELOP A DECISION RULE

The purpose of DQO Step 5 initially is to define the statistical parameter of interest (that is, maximum or 95 percent upper confidence level that will be compared to the action level). The statistical parameter of interest specifies the characteristic or attribute that a decisionmaker would like to know about the population. The preliminary cleanup level for each of the COPCs also is identified in DQO Step 5. When this is established, a decision rule (DR) is developed for each DS in the form of an "IF...THEN..." statement that incorporates the parameter of interest, the scale of decisionmaking, the preliminary action level, and the AAs that would result from resolution of the decision. Note that the scale of decisionmaking and AAs was identified earlier in DQO Steps 4 and 2, respectively.

5.1 INPUTS NEEDED TO DEVELOP DECISION RULES

Tables 5-1, 5-2, and 5-3 present the information needed to formulate the DRs in Section 5.2. This information includes the DSs and AAs identified in DQO Step 2, the scale of decisionmaking identified in DQO Step 4, and the statistical parameters of interest and preliminary action levels for each of the COPCs.

Table 5-1. Decision Statements.

DS #	Decision Statement
1	Determine if there is chemical constituent(s) within the pipeline systems and select an appropriate alternative action.
2	Determine if there is chemical constituent(s)within the surrounding soils and select an appropriate alternative action.
3	Determine if there is radiological constituent(s) within the pipeline systems and select an appropriate alternative action.
4	Determine if there is radiological constituent(s) within the surrounding soil and select an appropriate alternative action.
5	If the constituent(s) is a dangerous waste in accordance with WAC 173-303, then select an appropriate alternative action.

[a] TRU = radioactive waste containing more than 100 nCi/g (3700 Bq/g) of alpha-emitting transuranic isotopes with half-lives greater than 20 years, other than the exceptions noted in DOE G 435.1-1, Chapter 3, "Transuranic Waste Requirements."

Table 5-2. Inputs Needed to Develop Decision Rules. (2 Pages)

DS #	COPCs	Parameter of Interest	Statistic [a]	Scale of Decision-Making	Preliminary Cleanup Levels
1	Non-radiological constituents	Mean, maximum, or detected values	95% upper confidence limit of the mean, maximum, or detected values	Pipelines	Concentrations based on WAC 173-340-745(5) Method C, WAC 173-340-740(3) Method B, WAC 173-340-7493, WAC 173-340-900, Table 749-3, or WAC 173-340-747(4) Method B (see values identified in Table 3-5b).
				Pipeline appurtenances	
				Plugged pipelines	
2				Known leakage areas	
				Suspect leakage areas	
				Unknown leakage areas	
3	Radiological constituents			Pipelines	Direct radiological exposure dose rate of 15 mrem/yr above background and groundwater radiological exposure dose rate limit of 4 mrem/yr above background, based on the fate and transport modeling.
				Pipeline appurtenances	
				Plugged pipelines	
4				Known leakage areas	Direct radiological exposure dose rate of 15 mrem/yr above background and groundwater radiological exposure dose rate limit of 4 mrem/yr above background, based on RESRAD modeling (ANL 2002). Terrestrial wildlife cleanup values determined using the Biota Concentration Guide, as discussed in DOE-STD-1153-2002.
				Suspect leakage areas	
				Unknown leakage areas	

Table 5-2. Inputs Needed to Develop Decision Rules. (2 Pages)

DS #	COPCs	Parameter of Interest	Statistic [a]	Scale of Decision-Making	Preliminary Cleanup Levels
5	Dangerous waste constituents	Mean, maximum, or detected values	95% upper confidence limit of the mean, maximum, or detected values	Pipelines	Based on WAC 173-303
				Pipeline Appurtenances	
				Plugged Pipelines	

[a] Maximum detected values only can be used to determine if concentrations exceed preliminary cleanup levels. The maximum detected value cannot be used for a determination of absence of contamination or the lateral extent of contamination.

ANL, 2002, *RESRAD for Windows*, Version 6.21.
DOE-STD-1153-2002, 2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota.*
WAC 173-303, "Dangerous Waste."
WAC 173-340-740(3), "Unrestricted Land Use Soil Cleanup Standards," "Method B Soil Cleanup Levels for Unrestricted Land Use."
WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels."
WAC 173-340-747(4), "Deriving Soil Concentrations for Ground Water Protection," "Fixed Parameter Three-Phase Partitioning Model."
WAC 173-340-900, "Tables."
WAC 173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures."

DS = decision statement.
RESRAD = RESidual RADioactivity dose model.

Pipeline degradation is not a consideration for protection against exposure to nonradionuclides, because generally they do not decay with time

The AAs identified in DQO Step 2 are summarized in Table 5-3.

Table 5-3. Alternative Actions. (2 Pages)

PSQ #	AA #	Alternative Actions
1	1-1a	Evaluate the need for remedial action alternatives in a FS. [a]
	1-1b	Evaluate the no-action alternative in an FS. [a]
	1-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to pipeline system decision-making, based on field screening data and/or analytical data and take appropriate actions.
	1-3	Evaluate the need for additional sampling.
2	2-1a	Evaluate the need for remedial action alternatives in an FS. [a]
	2-1b	Evaluate the no-action alternative in an FS. [a]
	2-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to piping system decision making, based on field screening data and/or analytical data and take appropriate actions.
	2-3	Evaluate the need for additional sampling.

Table 5-3. Alternative Actions. (2 Pages)

PSQ #	AA #	Alternative Actions
3	3-1a	Evaluate the need for remedial action alternatives in an FS. [a]
	3-1b	Evaluate the no-action alternative in an FS. [a]
	3-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to piping system decision making, based on field screening data and/or analytical data and take appropriate actions.
	3-3	Evaluate the need for additional sampling.
	3-4	Evaluate the need for remedial action alternatives that include TRU contamination in an FS. [a]
	3-5	Evaluate the need for remedial action alternatives that includes greater than Class C waste concentrations in an FS. [a]
4	4-1a	Evaluate the need for remedial action alternatives in an FS. [a]
	4-1b	Evaluate the no-action alternative in an FS. [a]
	4-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to piping system decision making, based on field screening data and/or analytical data and take appropriate actions.
	4-3	Evaluate the need for additional sampling.
	4-4	Evaluate the need for remedial action alternatives that include TRU contamination in an FS. [a]
	4-5	Evaluate the need for remedial action alternatives that includes greater than Class C waste concentrations in an FS. [a]
5	5-1a	Evaluate the need for remedial action alternatives in an FS. [a]
	5-1b	Evaluate the no-action alternative in an FS. [a]
	5-2	Evaluate a streamed-line approach (e.g. CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD etc.) to piping system decision making based on field screening data and/or analytical data and take appropriate actions
	5-3	Evaluate the need for additional sampling.

[a] May include innovative decision making approaches (e.g., probabilistic).

AA = alternative action.
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980.*
FS = feasibility study.
PSQ = principal study question.
ROD = record of decision.
TRU = transuranic.

5.2 DECISION RULES

The output of DQO Step 5 and the previous DQO steps are combined into "IF...THEN" DRs that incorporate the parameter of interest, the scale of decision making, the action level, and the actions that would result from resolution of the decision. The DRs are listed in Table 5-4.

Table 5-4. Decision Rules. (2 Pages)

DR #	Constituents/ Media	Decision Rule
1	Nonradiological/ pipeline structures	PHASE 1. If the concentration of chemical constituents in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the maximum or detected values) is greater than or equal to the preliminary cleanup levels, select an appropriate alternative action (refer to Table 5-3). Excludes Alternative Action 1-1b. Otherwise, evaluate the need for additional sampling. PHASE 2. If the concentration of chemical constituents in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the 95% upper confidence limit of the mean) is greater than or equal to the preliminary cleanup levels, select an appropriate alternative action (refer to Table 5-3). Otherwise, evaluate leaving the pipelines, pipeline appurtenances, or plugged pipelines in place.
2	Nonradiological/ soil	PHASE 1. If the concentration of chemical constituents (as estimated by the maximum or detected values) in vadose zone soils in known leakage areas, suspect leakage areas, and/or unknown leakage areas is greater than or equal to the preliminary cleanup levels in Table 3-6b or 3-7b, select an appropriate alternative action (refer to Table 5-3). Excludes Alternative Action 2-1b. Otherwise, evaluate the need for additional sampling. PHASE 2. If the concentration of chemical constituents (as estimated by the 95% upper confidence limit of the mean) in the vadose zone soils is greater than or equal to the preliminary cleanup levels in Tables 3-6b or 3-7b, select an appropriate alternative action. Includes evaluating the no-action alternative in a feasibility study.
3	Radiological/ pipeline structures	PHASE 1. If the activity of radionuclides in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the maximum or detected values) results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background or a groundwater radiological dose greater than or equal to 4 mrem/yr above background (based on fate and transport modeling), select an appropriate alternative action (refer to Table 5-3). Excludes Alternative Action 3-1b. Otherwise, evaluate the need for additional sampling. PHASE 2. If the activity of radionuclides in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the 95% upper confidence limit of the mean) results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background or a groundwater radiological dose greater than or equal to 4 mrem/yr above background (based on fate and transport modeling) after pipeline degradation, select an appropriate alternative action. Otherwise, evaluate leaving the pipelines, pipeline appurtenances, or plugged pipelines in place.
4	Radiological/ soil	PHASE 1. If the activity of radionuclides (as estimated by the maximum or detected values) in vadose zone soils in known leakage areas, suspect leakage areas, and/or unknown leakage areas results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background, a groundwater radiological dose greater than or equal to 4 mrem/yr above background (based on fate and transport modeling), or 0.1 rad/d for protection of terrestrial animals select an appropriate alternative action (refer to Table 5-3). Excludes Alternative Action 4-1b. Otherwise, evaluate the need for additional sampling. PHASE 2. If the activity of radionuclides (as estimated by the 95% upper confidence limit of the mean) in vadose zone soils in known leakage areas, suspect leakage areas, and/or unknown leakage areas results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background or a groundwater radiological dose greater than or equal to 4 mrem/yr above background (based on the fate and transport modeling), or 0.1 rad/d for protection of terrestrial animals select an appropriate action. Includes evaluation of the no-action alternative in a feasibility study.

Table 5-4. Decision Rules. (2 Pages)

DR #	Constituents/ Media	Decision Rule
5	Dangerous Waste	PHASE 1. If the concentration of chemical constituents in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the maximum or detected values) is greater than or equal to the preliminary cleanup levels, select an appropriate alternative action (refer to Table 5-3). Excludes Alternative Action 1-1b. Otherwise, evaluate the need for additional sampling. PHASE 2. If the concentration of chemical constituents in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the 95% upper confidence limit of the mean) is greater than or equal to the preliminary cleanup levels, select an appropriate alternative action (refer to Table 5-3). Otherwise, evaluate leaving the pipelines, pipeline appurtenances, or plugged pipelines in place.

[a] TRU = radioactive waste containing more than 100 nCi/g (3700 Bq/g) of alpha-emitting transuranic isotopes with half-lives greater than 20 years, other than the exceptions noted in DOE G 435.1-1, Chapter 3, "Transuranic Waste Requirements."

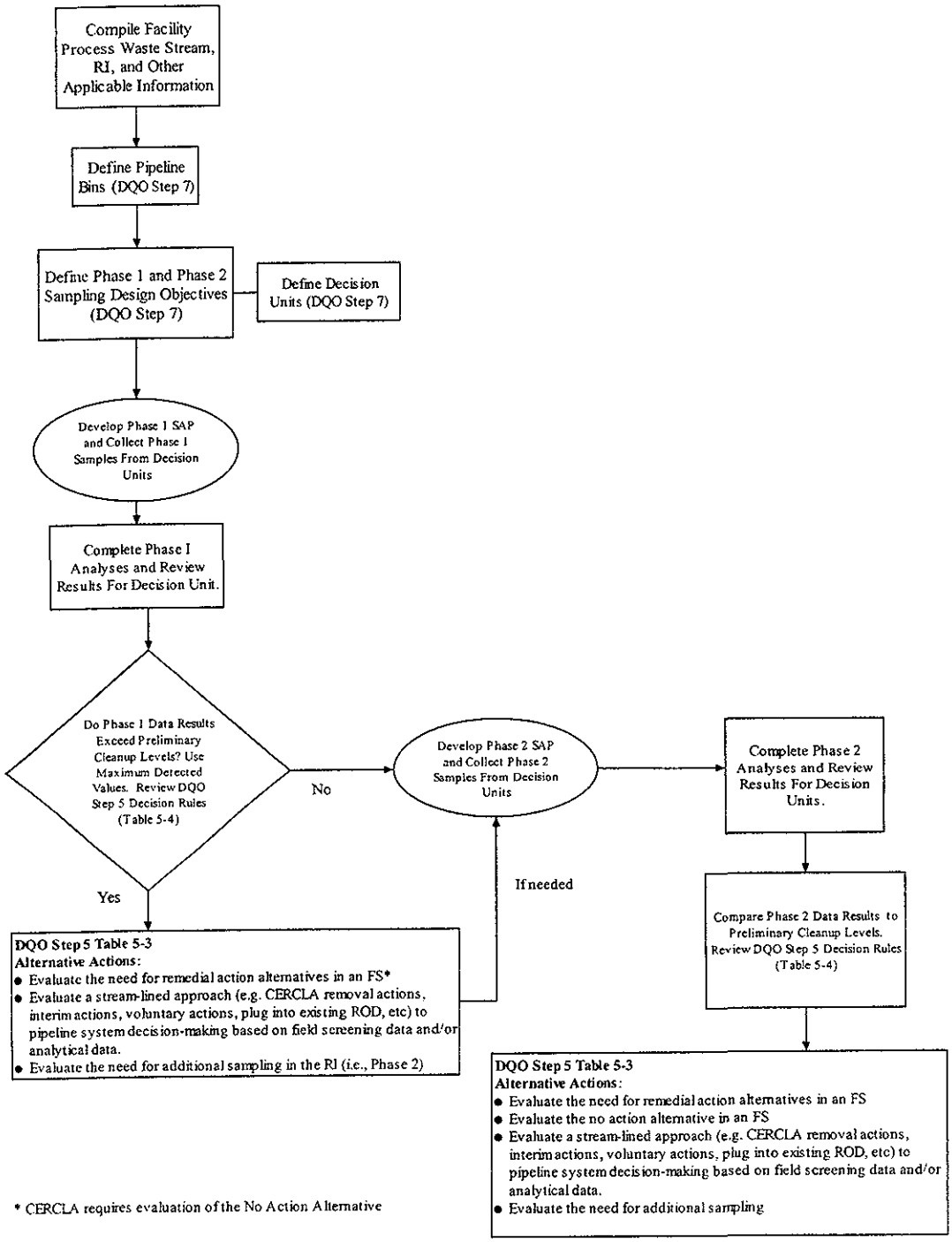
The DRs for the pipeline systems consist of two phases. The two-phase approach is discussed in greater detail in Steps 6 and 7.

- Phase 1 of each DR is associated with a minimal sampling effort. Based on existing information that indicates that contamination likely is present, data are collected to determine whether contamination is above the preliminary cleanup levels and remediation is required.

- Phase 2 of each DR requires the use of a data set sufficient to support remedial decision making including a no-action decision. Phase 2 entails the use of a larger data set and statistics to determine the contamination status.

Phases 1 and 2 may be applied in sequence or potentially separately, if appropriate for the sampling design. For example, Phase 1 sampling could be completed with the results indicating that there is no need to complete Phase 2 sampling for decision making. Or in some cases, because of the characteristics of the pipeline system, Phase 2 sampling results will be needed for decision making. The Phase 1 and 2 sample designs are presented in DQO Step 7. A process flow diagram showing the relationship of the Step 5 activities with other DQO activities for the pipeline systems is shown in Figure 5-1.

Figure 5-1. Process Flow for Step 5 and Related Activities.



This page intentionally left blank.

6.0 STEP 6 – SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

Because analytical data only can estimate the true condition of the site under investigation, decisions that are made based on measurement data potentially could be in error (that is, decision error). For this reason, the primary objective of DQO Step 6 is to determine which DRs (if any) require a statistically based sample design.

6.1 STATISTICAL VERSUS NONSTATISTICAL SAMPLING DESIGN

Table 6-1 provides a summary of the information used to support the selection between a statistical versus a nonstatistical sampling design for each DR. The factors that were taken into consideration in making this selection included the time frame over which each of the DRs applies, the qualitative consequences of an inadequate sampling design, and the accessibility of the site if resampling is required.

As discussed in Step 5, a two-phase sampling approach will be implemented, as needed, for the pipeline system RI. Phase 1 will consist of acquisition of a data set that is smaller than that of Phase 2.

The purpose of the Phase 1 investigation is to gather limited additional data in support of existing information that indicates that contamination likely is present at concentrations above preliminary cleanup levels. The data collected will be used to determine whether contaminant levels are consistently above action levels and to support remedial decision making (other than the no-action alternative).

The Phase 2 investigation will be used if Phase 1 results show a range of concentration values that are both above and below or close to preliminary cleanup levels. Proceeding directly to Phase 2 sampling would be appropriate for those pipelines where existing information indicates that contamination will not be present and/or where there is expected to be considerable variability in potential results. Phase 2 sampling will be required if all remedial alternatives need to be assessed, including the no-action alternative. Phase 2 sampling requires a larger data set for decision-making. Table 6-1 addresses both Phase 1 and Phase 2 sampling designs.

Table 6-1. Statistical Versus Nonstatistical Sampling Design.

DR #s	Phase	Time Frame (Years)	Qualitative Consequences of Inadequate Sampling Design (Low/ Moderate/Severe)	Resampling Access After Remedial Investigation (Accessible/Inaccessible)	Proposed Sampling Design (Statistical/ Nonstatistical)
All	Phase 1	Multiyear	Low	Accessible	Statistical/ Nonstatistical
All	Phase 2	Multiyear	Moderate/Severe	Accessible	Statistical

DR = decision rule.

6.2 NONSTATISTICAL DESIGNS

Collection of data using a nonstatistical sampling design for Phase 1 is appropriate for resolving the decision rules when the data are used for assessment of remedial decisions, other than the no-action alternative. The consequences of an inadequate sampling design are considered low, because additional data can be gathered if needed in Phase 2.

A biased (or focused) sampling approach, which targets areas of potential contamination within the pipeline systems, is considered applicable for the Phase 1 RI.

6.3 STATISTICAL DESIGNS

A probability (i.e., statistical) sampling design is appropriate for the Phase 2 investigation to address the parts of the decision rules requiring a statistical analysis of the data set. For a statistical sampling design, sample collection numbers will need to be of sufficient quantity and in sufficiently diverse locations that potential contaminant variability (both constituent type and concentration) is captured by the data set. Because of the length and expanse of the pipeline system requiring evaluation, an acceptable uncertainty in the data distribution used for decision-making will be required. Use of the 95 percent upper confidence limit of the mean accounts for the uncertainties associated with the limited sampling data that can be acquired for large waste sites. The 95 percent upper confidence limit provides reasonable confidence that the true site average concentration will not be underestimated (EPA, 1992, *Supplemental Guidance to RAGS: Calculating the Concentration Term*, OSWER Publication 9285.7-081).

Several probability sampling designs for sampling along a line to estimate a mean are available and are used for environmental sampling (Gilbert, 1987, *Statistical Methods for Environmental Pollution Monitoring*). Statistical sampling designs to be considered include the following:

- Simple Random Sampling – samples chosen at random
- Stratified Random Sampling – samples chosen at random within strata. Strata usually are different in size and are based on prior information about variation. Useful when a heterogeneous population can be broken down into parts that are internally homogeneous
- Random Sampling Within Segments – One or more samples chosen at random within a pipeline segment. Segments may be different sizes, not based on prior information about variation (Gilbert, 1987)
- Systematic Random Sampling – Random selection of the interval of data collection. Includes definition of a specific number of samples collected within a specified population size. This involves a randomly chosen start location with systematic placement of subsequent additional sample locations in a sampling grid.

Access restrictions and limitations are expected in implementing random sample collection for the pipelines, and adjustments to planned versus actual sample collection points are anticipated. Phase 1 sample results, if available, will be evaluated prior to selection of the appropriate statistical sampling design for use in Phase 2. The methodology(s) that will be used for

evaluation of the sample population characteristics and criteria used for data sufficiency for decision-making will be provided in the 200-IS-1 OU Work Plan.

6.4 POTENTIAL SAMPLE LIMITATIONS

Constraints may be encountered during the data collection process. These limitations include physical barriers, difficult sample matrices, insufficient sample volume, high-radiation areas, or any other condition that will need to be taken into consideration in the design of the sampling program. Additionally, sample holding times may be exceeded because of the high activity level of the sample or activity limits at the analytical laboratory. These limitations plus measurement error contribute to the total study. The errors are discussed here in the DQO to recognize the limitations and plan appropriate actions in the project quality assurance plan.

This page intentionally left blank.

7.0 STEP 7 – OPTIMIZE THE DESIGN

7.1 PURPOSE

The purpose of DQO Step 7 is to present data collection designs that meet the minimum data quality requirements specified in DQO Steps 1 through 6. Additional elements of Step 7 include the following:

- Binning pipelines into process-based groups (e.g., decision units) that are related to waste type received and the operational aspects of the process pipeline
- General sample design application for Phases 1 and 2
- Phase 1 assumptions, objectives, and investigation techniques
- Phase 2 assumptions, objectives, and investigation techniques
- Decision units and sampling activities for Phase 1
- Sample design limitations.

This section presents the general objectives and approaches for the characterization of the process-waste pipeline systems. Investigative and sampling techniques have been identified that are aligned with the key elements of the 200-IS-1 OU pipeline systems conceptual site model. To optimize sample design, a phased characterization approach is proposed that sufficiently accommodates evaluation and assessment of the data for decision-making.

Information regarding the characteristics of pipeline system appurtenances (i.e., catch tanks, diversion boxes, valve pits) is limited. These components have a higher degree of complexity with regard to access and sampling for conducting characterization. This complexity does not make these components amenable to the Phase 1 characterization. These components will be addressed as part of the more rigorous Phase 2 sampling and analysis. Based on the results of Phase 1 for pipelines, either this DQO will be revised to address these components or an existing approved SAP for these components will be identified/modified to support the Phase 2 data collection and characterization.

7.1.1 Overview

To corroborate the conceptual models presented in Step 1 of the DQO, a phased approach was chosen to obtain data. The Phase 1 evaluation will employ field-screening techniques, with limited laboratory analyses. It will provide a general assessment concerning the presence or absence of COPCs at concentrations above preliminary cleanup levels. For Phase 2 characterization activities, the data collection process will include samples for laboratory analyses to support a risk assessment as part of a systems approach to decision making.

Phase 1 activities will be a combination of intrusive and nonintrusive activities. Data collected during Phase 1 will contribute to a better understanding of the conceptual model. Phase 1 will consist of a biased sample approach targeting specific pipelines and specific locations within or around these pipelines; however, if a suspected area of waste accumulation cannot be identified, then pipelines and surrounding soil locations will be selected randomly. Evaluation of the Phase 1 sampling data will guide the remaining activities in the RI/FS process. These data may be determined to be sufficient for proposing a streamlined remedial decision-making process (i.e., contingent remedy, plug-in-approach, focused package, or observational approach). Reiterative Phase 1 sampling may be necessary before, during, or in lieu of Phase 2 sampling.

Phase 2 sampling will be initiated as stated above or when there is uncertainty concerning whether contamination above a preliminary cleanup level is present. Phase 2 sampling will entail a more extensive intrusive sampling and laboratory analyses evaluation plus collection of a larger data set. Phase 2 data will support decision documents and RI/FS processes.

7.1.2 Binning Pipelines

Considerable process knowledge is available concerning the waste streams generated at the facilities in the 200 Areas. The 200 Areas have been the center for separations and concentration processes of plutonium and transfer of Tank Farm wastes. These separation and concentration processes plus the transfers can be grouped into six general processes:

1. Fuel processing
2. Plutonium isolation
3. Uranium recovery
4. Cesium/strontium recovery
5. Waste storage/treatment
6. Tank farm waste transfers

DOE/RL-96-81 translated the first five general processes into logical waste site groups based on waste stream type (e.g., solid waste, cooling water, process waste), followed by waste site type (e.g., burial ground, pond, trench, ditch, crib). Inventory records of the major radionuclide, inorganic, and organic constituents comprising the waste streams generated from the 200 Areas facilities and discharged to waste disposal sites are presented in DOE/RL-96-81, Appendix A.

The general waste stream categories identified in DOE/RL-96-81, Section 3.2, and DOE/RL-98-28, Appendix H, form the basis for the OU designations used for the Central Plateau soil waste sites. These OU waste stream categories also provide a basis with which to organize the pipeline systems for characterization activities. The waste stream categories share common radiological and chemical attributes and provide a mechanism with which to group or "bin" the pipelines that handled each type of process liquid. This grouping logic relies on process knowledge associated with the facility operations and the fact that the pipelines within each designated group conveyed liquid wastes that generally share common compositional attributes. The bins for the pipeline systems are shown in Table 7-1. Summary information provided in this table includes the five bins, organized by OUs identified for the 200 Areas, and a general description of the waste stream characteristics. A sixth bin has been included for the tank-transfer waste streams. This sixth group is unique from the other five bins, because it

contains pipeline systems that received waste from varying generating sources and therefore may not share common compositional attributes as do the other bins. The wastes originated from a number of defense-related operations associated with removing cladding from spent nuclear fuel, purifying the plutonium product, decontaminating equipment /facilities, and performing laboratory analyses. Further, with limited tank volume, transfers between tank farms became an operational necessity. As such, these pipelines conveyed a wide range of wastes from multiple processes.

Table 7-1. Pipeline System Waste Stream Groups.

Waste Category Bin	Waste Steam Description
Process Condensate, Process Waste, and Chemical Laboratory Waste (Waste streams associated with the 200-PW-1, -2, -3, -4, -5,and -6 OUs plus the 200-LW-1 and -2 OUs)	• Process condensate generally is water condensed from the closed process system and that was in direct contact with radioactive and chemical materials. • Process waste is low-level and/or hazardous waste that directly contacted radioactive material and that may contain organic complexants that could enhance their mobility. • Potential TRU waste associated with the 200-PW-1, -2, and -6 and 200-LW-2 OU waste streams. • CCl_4 associated with the 200-PW-1 OU waste stream. • Laboratory process wastes and/or laboratory decontamination waste streams that generally are low in radionuclides, although some have significant inventories of plutonium, uranium, and fission products. Liquid volumes are typically lower.
Steam Condensate and Cooling Water (Waste streams associated with the 200-CW-1, -2, -3, -4, and -5 OUs and the 200-SC-1 OU)	• These waste streams were run in a non-contact manner; that is, a barrier separated the liquids in this category from contaminated process liquids, with little consequent potential for routine radiological contamination. However, contamination did enter these streams in generally negligible to very small quantities through pinhole leaks or through rare pipe ruptures. • Potential TRU waste associated with the 200-CW-5 OU waste stream.
Chemical Sewer Waste (Waste streams associated with the 200-CS-1 OU)	• Chemical sewer waste sites received solvent extraction waste that was generally low in all radiological contaminants.
Miscellaneous Waste (Waste streams associated with the 200-MW-1 OU)	• Generally consists of waste streams low in radionuclide and chemical constituents. Waste streams associated with plant ventilation and stack drainage, equipment decontamination, and a number of small- to medium- volume radioactive waste streams from multiple sources. • The relationship of the 216-A-4 Crib's high radiological constituent levels to the general waste characteristics of this group is uncertain
Tank/Scavenged Waste (Waste streams associated with the 200-TW-1 and -2 OUs)	• Consists of waste streams with relatively high concentrations of radiological constituents. These liquid wastes are associated directly or indirectly with tank wastes collected from the Bismuth-Phosphate process. • Potential TRU waste associated with the 200-TW-2 OU waste stream.
Tank Farm Waste Transfer	• Multiple waste stream compositions, generally consisting of high concentrations of radionuclides. • Variability in the waste stream composition.

OU = operable unit. TRU = transuranic.

Table 7-2 identifies the Hanford Site process facility areas where process-waste pipelines conveyed these process bins.

Table 7-2. Identification of Process-Waste Pipeline Groups in 200 Areas Facilities.

Facility Area	Waste Streams Transferred Within Pipeline Systems					
	Process Condensate and Process Waste	Steam Condensate and Cooling Water	Chemical Sewer and Chemical Laboratory Waste	Miscel-laneous Waste	Tanks/ Scavenged Waste	Tank Farm Waste Transfers
200 East Area						
B Plant	X	X	X	X	X	X
A Plant (PUREX)	X	X	X	X	---	X
Hot Semiworks	X	X	---	X	X	X
200 West Area						
S Plant (REDOX)	X	X	X	X	---	X
T Plant	X	X	X	X	X	X
Z Plant (PFP)	X	X	X	X	---	X

X – Indicates that pipeline systems present in the facility area were used to transfer the specified waste stream.
--- Indicates that no pipeline system was identified that carried the waste stream.

PFP = Plutonium Finishing Plant.
PUREX = Plutonium-Uranium Extraction Plant.
REDOX = Reduction-Oxidation Plant.

7.1.3 General Conceptual Site Model

The 200-IS-1 OU pipeline systems and appurtenances are buried structures used to convey and store various liquid process-waste streams to storage tanks and/or disposal waste sites located within the Hanford Site Central Plateau area. Generally, the process pipeline systems used for liquid discharge to disposal waste sites currently are inactive. Some laboratory waste transfer lines are still in use.

These liquid waste conveyance structures are buried at depths ranging from several feet to tens of feet below the ground surface. Engineering designs and as-built drawings provide information on the locations of the pipelines and associated structures, construction materials, and pipe diameters. Burial depths can be determined at intermittent locations, based on survey elevation data for the bottoms of the pipelines (i.e., inverts) provided on engineering drawings. Pipe materials vary and include cast iron, carbon steel, stainless steel, vitrified clay, polyethylene, polyvinyl chloride, corrugated metal, and concrete.

Information concerning the current condition of the pipeline structures is limited. Evidence of potential leaks to the surrounding soil in some areas has been documented based on visual observations, hand-held radiological instrument readings and/or limited sampling. These known soil contamination areas are identified as unplanned release waste sites in the *Waste Information Data System* database.

7.1.4 Contaminant Distribution

The following section provides a general discussion concerning the current assumptions about the potential distribution of contaminants inside pipelines and in soil adjacent to pipelines.

Inside Pipelines

Data are not available concerning the concentrations and distribution of contaminants inside the majority of the pipelines. A summary of the information compiled from previous waste site investigations that have included an evaluation of a pipeline segment is provided in Appendix A. Process operations that included flushing of the line after transmission of waste streams are known to have occurred for some pipelines, particularly those lines that are part of the tank farm waste transfer network. Documentation concerning the existence of some plugged pipelines has been compiled (RPP-25113, *Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site*). Information regarding the characteristics of specific residual waste that may reside within pipeline system components (i.e., pipelines, catch tanks, diversion boxes, valve pits) is limited. Residual material, if present, may occur as scale, corrosion products, sludge, and/or sediment. Pipeline materials such as vitrified clay may have sorbed waste stream constituents.

Information pertaining to the general composition of the waste streams handled at each facility and transmitted within the pipeline systems is derived from a number of sources including: facility process operation descriptions, inventory calculations (RPP-26744, *Hanford Soil Inventory*), and liquid disposal site characterization results presented in the 200 Areas RI reports.

There are several materials of construction for the process-waste pipelines. These materials of construction will be compared to the liquid waste type(s) conveyed to the disposal sites. If incompatible waste(s) was conveyed through the pipeline(s), then the potential for failure will be assessed based on the quantity of waste material conveyed and the degree of incompatibility between the waste and the pipeline material.

- **Pressurized Pipelines**

Pressurized pipelines typically conveyed waste from the generating facility to the tank farm or between tank farms. Typically, these lines were flushed after the waste was conveyed to its destination. The potential exists for accumulation of scale or sludge or waste product within this type of pipeline system.

- **Gravity Pipelines**

Many of the disposal sites on the Central Plateau received liquid waste from gravity pipelines. These pipelines over time tend to accumulate debris and sludge. Depending on the length of use and the waste-stream type, debris may accumulate through the pipeline. The conceptual model for this type of pipeline would show waste accumulation within the pipe and at low points, if present.

Soil Adjacent to Pipeline Structures

The potential distribution of contaminants in the soil surrounding the pipeline structures is assumed to be variable and to depend on a number factors. The occurrence and magnitude of potential releases would be affected by the integrity of fittings at pipe joints, breaks or fractures in the line related to loading or subsidence, and degradation associated with age and incompatibility of waste streams and pipeline materials. The extent of vertical and/or lateral migration in surrounding soil would be related to factors such as: size of the release opening, period of time the release occurred, whether the release was under pressure, the soil characteristics (e.g., porosity and permeability), and the total volume of liquid that was discharged.

Unplanned releases to the soil may have occurred when pressurized lines failed. Pipelines transferring waste streams to tanks often would be under pressure to facilitate the use of diversion boxes and rerouting of waste streams. It is assumed that gravity flow pipelines that conveyed waste destined for discharge to disposal sites such as cribs, trenches, and french drains would be less likely to experience failure because of the lack of pressurization. However, there are examples where unplanned releases have occurred in gravity-flow pipelines (e.g., 200-W-42 Vitrified Clay Pipeline).

General construction characteristics of pipelines include direct burial of single pipes or placement of multiple pipelines within a concrete encasement. Direct buried pipelines occur within an excavated trench that has been backfilled with soil. Soil surrounding the pipeline includes underlying compacted base/bedding material used to support the pipeline and compacted soil immediately to the sides and above the pipeline to reduce subsidence. Generalized cross-sectional views of a direct-buried single pipeline and encased multiple pipeline are shown in Figures 1-5 and 1-6 in Step 1. For pipelines where inadvertent liquid releases to the surrounding soil have occurred, the contaminant distribution may be limited to the shallow zone soil interval (i.e., the interval from the ground surface to a depth of 4.6 m [15 ft]) and could extend to a deeper depth. Liquid releases at pipeline failure locations may display simple or complex concentration distributions within the impacted soil area, depending on the characteristics of the waste stream.

- **Vertical Contaminant Distribution**

  The specific vertical contaminant distribution in the soil will depend on several influencing factors: volume of the release, time period over which the release occurred, waste stream composition, and mobility of the constituents (e.g., soil-water partition distribution coefficients, porosity/permeability of the sediments).

  For small-volume release to surrounding soil associated with minor pipe joint offsets or small cracks or fractures, it is expected that the vertical contaminant migration will be limited to within several feet of the bottom of the structure. Large-magnitude releases could result in vertical migration (toward the surface or toward the groundwater) of contaminants in the soil to depths of tens of feet.

- **Lateral Contaminant Distribution**

  Some lateral migration could occur of liquid releases from pipelines within the impacted soils, and the spread of the contamination would depend on site-specific conditions and the volume of the release. For small volume releases, lateral spreading might be greater than vertical migration, while for large volume releases vertical migration might be greater than lateral migration because of the hydraulic head associated with the large volume release and its preference for vertical migration. However, this is dependent on soil stratigraphy.

7.2 GENERAL SAMPLE DESIGN PROCESS

Phase 1 characterization activities will be used to determine if constituent concentrations exceed preliminary action levels in soil and pipelines. For Phase 1, locations selected for collection of data inside pipelines will be based on a biased sampling approach, targeting areas of waste accumulation, if these areas can be predetermined. If these areas are not evident, a random selection process will be used to determine sampling locations. For soils, Phase 1 sampling will occur at locations where the assumed greatest potential to encounter contamination exists.

Outcomes of the Phase 1 sampling process include the following:

- Evaluation of how future pipeline characterization may be accomplished (e.g., innovative technologies, field screening techniques)
- Compilation of cost information for characterization activities
- Compilation of data to support waste designation requirements
- Refinement of the conceptual model.

The option to bypass Phase 1 sampling and proceed directly to the more extensive characterization associated with Phase 2 sampling can be selected.

Phase 2 sampling will be used for evaluation of those pipelines and associated structures where there is considerable uncertainty concerning whether contamination exceeding action levels is present (see Figure 5-1). Phase 2 sampling will entail a more extensive evaluation and collection of a larger data set than Phase 1.

Table 7-3 identifies the rationale for determining the sampling design.

Table 7-3. Determine Data Collection Design.

DS	Application	Statistical or Nonstatistical Sampling Design	Rationale
All	Phase 1	Nonstatistical	Phase 1 will consist of a biased sample process targeting specific pipelines and specific locations within pipelines and soils around these pipelines; however, if a suspected area of waste accumulation cannot be identified, then locations for sampling within pipelines and/or surrounding soil will be selected randomly. A biased sampling design is applicable for the Phase 1 investigation, because data can be used for the initial determination of whether a particular pipeline waste group is contaminated. Consequences of erroneous decisions are not severe, because a Phase 2 investigation is needed for a no-action remedial alterative.
	Phase 2	Statistical	A statistical sampling design is applicable for the Phase 2 pipeline and soils evaluation to ensure that a data set of sufficient size has been collected for use in making remedial decisions, including the no-action alternative. The number of samples required to achieve an acceptable statistical error in the data set will be negotiated with the regulators prior to completion of the sampling and analysis plan.

DS = decision statement.

Tables 7-4 and 7-5 are used to develop general data collection design alternatives for Phases 1 and 2. If the data collection design for a given decision will be nonstatistical, determine what type of nonstatistical design is appropriate (that is, haphazard or biased). If the data collection design for a given decision will be statistical, determine what type of statistical design is appropriate (that is, random, stratified random, random within segments, or systematic).

Table 7-4. Determine Nonstatistical Sampling Design.

DR #	Haphazard[a]	Biased
All	None. Only appropriate if contaminant characteristics are completely homogeneous at all locations within the entire pipeline system.	A biased sampling design may be appropriate when contamination is known or assumed to be present at specific locations.

[a] Gilbert, 1987

Table 7-5. Determine Statistical Sampling Design.

DR #	Random	Stratified Random	Random Within Segments	Systematic
All	Suited for the evaluation of characteristics if no major patterns or trends are present.	May be appropriate for some waste group pipelines that require subdivision for evaluation, such as sampling applied to specific pipeline materials within a process bin.	May be appropriate for evaluation of selected waste group pipeline segments within different facility areas.	None. Pipeline system is too spread out and segmented to lay out systematic design.

Sampling design options are evaluated based on their ability to meet the DQO constraints and cost. This evaluation should lead to one of two outcomes: (1) the selection of a design that most efficiently meets all of the DQO constraints or (2) the modification of one or more outputs from DQO Steps 1 through 6 and the selection of a design that meets the new constraints.

7.3 PHASE 1 DESIGN ASSUMPTIONS AND CHARACTERIZATION OBJECTIVES

The sampling design is based on a two-phased investigation approach. Table 7-6 presents the Phase 1 assumptions and characterization objectives for each pipeline waste group. The table identifies initial assumptions and characterization objectives for the Phase 1 sampling event. These assumptions and objectives will be compared to the Phase 1 sampling results to evaluate the need for additional sampling or remedial action decisions. The methods identified to achieve the characterization objectives are presented in Table 7-7. Identification of the primary constituents associated with each process-waste group that could be used as indicators of contamination will be addressed in the 200-IS-1 OU Work Plan.

Table 7-6. Phase 1 Assumptions and Characterization Objective. (6 Pages)

Bin	Contaminant Characteristic Assumptions	Characterization Objectives	
		Within Pipeline Structures	Confirmed and Suspected Release Locations in Soil
Process Condensate Process Waste, Chemical Laboratory Waste	• Based on general waste stream characteristics [a], process inventory records, and disposal site sampling data, it is assumed that some radionuclides detected in this pipeline waste group often will exceed preliminary cleanup levels. • Large portions of this pipeline waste group may be contaminated. • Potential for TRU waste.	• Evaluate internal condition of structure. Formulate conceptual/analytical model of corrosion, based on pertinent factors (e.g., type and age of pipe, process knowledge for liquids in pipe, chemical and physical makeup of soil). Record the relative level of corrosion, presence of fractures or pipe separations, etc., as indicators for leakage susceptibility. • Collect samples for field screening to confirm detectable levels of nonradiological contamination. • Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.	• Collect samples for field screening to confirm detectable levels of nonradiological contamination. • Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses used mainly to evaluate nonradiological constituent concentrations.

Table 7-6. Phase 1 Assumptions and Characterization Objective. (6 Pages)

Bin	Contaminant Characteristic Assumptions	Characterization Objectives	
		Within Pipeline Structures	Confirmed and Suspected Release Locations in Soil
Steam Condensate and Cooling Water	• Based on general waste stream characteristics [a], process inventory records, and disposal site data, it is assumed that concentrations of radionuclides detected in this pipeline waste group often will not exceed preliminary cleanup levels. • Most of the pipelines in this waste group are assumed not to be contaminated.	• Evaluate internal condition of structure. Formulate conceptual/analytical model of corrosion, based on pertinent factors (e.g., type and age of pipe, process knowledge for liquids in pipe, chemical and physical makeup of soil). Record the level of corrosion, presence of fractures or pipe separations, etc., as indicators for leakage susceptibility. • Collect samples for field screening to confirm detectable levels of nonradiological contamination. Use field screening instrumentation to determine the level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.	• Collect samples for field screening to confirm detectable levels of nonradiological contamination. Use field screening instrumentation to determine the level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.

Table 7-6. Phase 1 Assumptions and Characterization Objective. (6 Pages)

Bin	Contaminant Characteristic Assumptions	Characterization Objectives	
		Within Pipeline Structures	Confirmed and Suspected Release Locations in Soil
Chemical Sewer Waste	• Based on general waste stream characteristics [a], process inventory records and disposal site data, it is assumed that concentrations of some radionuclides detected in this pipeline waste group often will exceed preliminary cleanup levels. • Large portions of this pipeline waste group may be contaminated. • Potential for TRU waste.	• Evaluate internal condition of structure. Formulate conceptual/analytical model of corrosion based on pertinent factors (e.g., type and age of pipe, process knowledge for liquids in pipe, chemical and physical makeup of soil). Record the relative level of corrosion, presence of fractures or pipe separations, etc., as indicators for leakage susceptibility. • Collect samples for field screening to confirm detectable levels of nonradiological contamination. Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.	• Collect samples for field screening to confirm detectable levels of nonradiological contamination. Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.

Table 7-6. Phase 1 Assumptions and Characterization Objective. (6 Pages)

Bin	Contaminant Characteristic Assumptions	Characterization Objectives	
		Within Pipeline Structures	Confirmed and Suspected Release Locations in Soil
Miscella-neous Waste	• Based on general waste stream characteristics [a], process inventory records, and disposal site data, it is assumed that concentrations of radionuclides detected in this pipeline waste group often will not exceed preliminary cleanup levels. • Most of the pipelines in this waste group are assumed not to be contaminated.	• Evaluate internal condition of structure. Formulate conceptual/analytical model of corrosion based on pertinent factors (e.g., type and age of pipe, process knowledge for liquids in pipe, chemical and physical makeup of soil). Record the relative level of corrosion, presence of fractures or pipe separations, etc., as indicators for leakage susceptibility. • Collect samples for field screening to confirm detectable levels of nonradiological contamination. Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.	• Collect samples for field screening to confirm detectable levels of nonradiological contamination. • Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.

Table 7-6. Phase 1 Assumptions and Characterization Objective. (6 Pages)

Bin	Contaminant Characteristic Assumptions	Characterization Objectives	
		Within Pipeline Structures	Confirmed and Suspected Release Locations in Soil
Tank/ Scavenged Waste	• Based on general waste stream characteristics [a], process inventory records, and disposal site data, it is assumed that concentrations for some radionuclides detected in this pipeline waste group often will exceed preliminary cleanup levels. • Large portions of this pipeline waste group are assumed to be contaminated. • Potential for TRU waste.	• Evaluate internal condition of structure. Formulate conceptual/analytical model of corrosion based on pertinent factors (e.g., type and age of pipe, process knowledge for liquids in pipe, chemical and physical makeup of soil). Record the relative level of corrosion, presence of fractures or pipe separations, etc., as indicators for leakage susceptibility. • Collect samples for field screening to confirm detectable levels of nonradiological contamination. Collect samples for field screening to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.	• Collect samples for field screening to confirm detectable levels of nonradiological contamination. Collect samples for field screening to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.

Table 7-6. Phase 1 Assumptions and Characterization Objective. (6 Pages)

Bin	Contaminant Characteristic Assumptions	Characterization Objectives	
		Within Pipeline Structures	Confirmed and Suspected Release Locations in Soil
Tank Farm Waste Transfer	• Based on general waste stream characteristics, process inventory records, and tank characterization data, it is assumed that concentrations for some radionuclides detected in this pipeline waste group may exceed preliminary cleanup levels. • Portions of this pipeline waste group are assumed to be contaminated. • Potential for TRU waste.	• Evaluate internal condition of structure. Formulate conceptual/analytical model of corrosion based on pertinent factors (e.g., type and age of pipe, process knowledge for liquids in pipe, chemical and physical makeup of soil). Record the relative level of corrosion, presence of fractures or pipe separations, etc., as indicators for leakage susceptibility. • Collect samples for field screening to confirm detectable levels of nonradiological contamination. • Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.	• Collect samples for field screening to confirm detectable levels of nonradiological contamination. Use field screening instrumentation to determine the relative level of radiological contamination. • Collect limited samples for laboratory analyses. Analyses mainly are used to evaluate nonradiological constituent concentrations.

[a] See Table 7-1.
TRU = transuranic.

Table 7-7. 200-IS-1 Operable Unit Piping System Sampling Design Elements. (4 Pages)

Investigation Technique or Sampling Method	Key Features of Characterization Activity	Purpose of Characterization Activity
	Inside Pipe	
Visual/video inspection	Direct observations regarding general pipe condition (i.e., presence of corrosion, breaks, breaches, cracks, or separated pipe joints) and presence/absence of waste residue (e.g., films, layers, sludge, sediment).	- Observations used to support assessment of pipe system condition. - Provides data to support conclusions regarding integrity of the pipeline. - Observations provide basis for conclusions concerning presence of residual waste. - Observations generally would be limited to a section of pipe within a few feet of the access point.
Hand-held radiological instrument readings	Direct radiological measurements of pipe surfaces. Radiological levels would be measured both outside and inside the pipe. Alpha, beta, and gamma radiation detectors would be used to provide general information on the radiation levels. Hand-held instrument detection capabilities are shown on Table 3-4a in Step 3.	- Hand-held radiological instrument readings would provide real-time data concerning the presence of radionuclides with activities above background. - Provides data concerning general magnitude of radiological contamination, if present. - Measurements would be used where focused samples are being collected (e.g., from high radiological contamination areas). - Instrument readings will be used in conjunction with samples collected for laboratory analyses to extrapolate radionuclide data to other pipe segments (of the same process waste stream), where only instrument measurement data were collected.
Deployed radiological measurement instrumentation	Instrumentation deployed into a pipe segment for up to several hundred feet to record radiological levels. Depending on radionuclides of interest, beta/gamma and/or alpha measurements would be collected. Several instrument configurations are possible, permitting collection of both radiological measurements and photographic information. Auxiliary Global Positioning System or other positional/location-recording devices may be incorporated into the data recording configuration as needed. Multiple techniques are available to deploy instrumentation for data collection along a pipe segment.	- Instrument readings would provide real-time data concerning the presence of radionuclides with activities above background. - Measurements would be used with other data when focusing sample collection locations. - Provides real-time data concerning general magnitude of radiological contamination, if present. - Instrument readings would be used in conjunction with any samples collected for laboratory analyses to extrapolate radionuclide data to other pipe segments (of the same process waste stream,) where only instrument measurement data were collected. - Deployment of a remote radiological measurement system would limit worker exposure when evaluating pipe sections with high radiological levels.
Swipe/smear samples	Swipe/smear samples are taken to determine if non-fixed radiological contamination is present on the inside pipe surface. These samples will be collected where there is an insufficient quantity of residual material present.	- Determination for the presence of non-fixed radiological contamination on the inside pipe surface. - Data used for characterization of gross alpha/beta/gamma levels on inside pipe surface.

Table 7-7. 200-IS-1 Operable Unit Piping System Sampling Design Elements. (4 Pages)

Investigation Technique or Sampling Method	Key Features of Characterization Activity	Purpose of Characterization Activity
Sludge and/or sediment samples	Collect samples of loose residual material accumulated within the pipeline for analysis of radiological and/or nonradiological constituents. Samples are collected at accessed locations where sufficient material is present for completion of laboratory analyses.	- Standard laboratory analyses completed to quantify concentrations of radiological and nonradiological constituents occurring in residual waste material. - Prioritization of analyses will be established, based on amount of material that can be collected. - Analytical results used for comparison to soil cleanup levels.
Pipe scale samples	Solidified residual material occurring on inside walls of pipeline will be collected for analysis of radiological and/or nonradiological constituents. Samples only are collected if material can be manually scraped from the walls of the pipe.	- Standard laboratory analyses are completed to quantify concentrations of radiological and nonradiological constituents occurring in scale. - Prioritization of analyses will be established, based on amount of material that can be collected. - Analytical results used for comparison to soil cleanup levels.
Pipe material sampling	Expose a section of pipeline and cut out a convenient length for laboratory analysis of composition and concentration of radiological and nonradiological constituents that have sorbed into the pipe material. Note – the need for this activity depends on regulatory characterization and disposal facility requirements (if removal is anticipated).	- Provides information on contaminant levels for constituents that have sorbed into the pipe material. - Leaching/acid etching process is conducted on a portion of the pipe to determine the composition and concentration of analytes extracted from pipe material. - Analytical results are used to determine which contaminants are present. (toxicity characteristic leaching procedure analysis conducted for nonradiological constituents). - Analytical results provide data for waste disposition decisions if removal of the pipeline section is selected as a remedial alternative.
Emerging and innovative technologies	For example, gas tracers	- Gas tracers provide an indication of constituents in pipelines.
	Soil	
Surface geophysical survey	Perform ground-penetrating radar and/or electromagnetic imaging over the general area of the selected pipeline section.	- Surface geophysical surveys are used to verify the location of pipelines prior to any intrusive activities. - Results are used to determine if any other undocumented buried structures occur in the area of interest.

Table 7-7. 200-IS-1 Operable Unit Piping System Sampling Design Elements. (4 Pages)

Investigation Technique or Sampling Method	Key Features of Characterization Activity	Purpose of Characterization Activity
Vertical geophysical survey	Install direct-push rods to a depth of 3.1 m (10 ft) below the bottom of the pipeline segment for gross gamma and passive neutron logging. Log to a maximum depth of 9.1 m (30 ft) bgs. Pushes will be installed around the pipeline location under investigation. There will be two locations on each side of the pipeline. Installation points will be offset approximately 0.9 to 1.8 m (3 to 6 ft) to the side of the pipeline.	- Vertical geophysical survey data will be used in the assessment of pipeline leaks by evaluating the presence of gamma-emitting radionuclides immediately adjacent to the pipe in areas where a release might have occurred. - Cs-137 is considered a good gamma radiation indicator of contamination because of its prevalence in the waste stream and ease of identification. - High levels of plutonium would be detected by the passive neutron detector. - Results mainly will be used to evaluate the vertical gross gamma contaminant distribution around the pipeline location. Offset lateral sampling points provide initial indication of potential horizontal extent of contamination, if present.
Driven soil core sampler	Collect soil sample from the depth interval of highest contamination detected at each vertical geophysical survey location. Submit sample for laboratory analysis of gross alpha, gross beta, gross gamma, gamma energy analysis, and inductively coupled plasma metals (in order of priority). At least one subsurface soil sample will be collected directly below the bottom of the pipe, even if no contamination is indicated by the vertical geophysical survey.	- Discrete soil samples will be collected to confirm levels of contamination or absence of contamination as indicated by vertical geophysical logging. - Analytical results provide concentration data for nonradionuclides.
Split-spoon soil samples	Split-spoon soil samples for laboratory analyses will be taken below ground surface to a maximum depth of 15.2 m (50 ft). The initial sample will be collected from the zone above the pipeline. An additional sample will be collected from the zone with the highest radiological levels identified by the vertical geophysical surveys, if this interval does not coincide with a planned depth.	- Analytical results will be used to indicate the vertical contaminant distribution in the vicinity of the pipeline. - Collection of samples deeper than 15.2 m (50 ft) bgs will be evaluated based on the results of the vertical geophysical survey and radiological screening measurements of the drill cuttings.
Emerging and innovative technologies	Driven soil-gas samplers	- Determine presence or absence of transuranic constituents based on presence of gaseous daughter products.

Table 7-7. 200-IS-1 Operable Unit Piping System Sampling Design Elements. (4 Pages)

Investigation Technique or Sampling Method	Key Features of Characterization Activity	Purpose of Characterization Activity
Test pits	Test pit excavations extending to a maximum depth of 7.6 m (25 ft) will be completed to expose sections of pipeline for making visual observations and for sample collection. Test pits will serve several purposes including the following: 1) Analysis of pipe leaks to soil. Radiological instrument reading will be performed as soil is removed. Focused samples may be collected at the location of the highest radiological instrument reading above background. Soil samples will be collected from an excavator bucket. 2) Also provides locations for accessing interior of pipelines (if needed).	- Provide visual indication of pipeline and surrounding soil conditions. - Permits instrument readings and collection of multiple sample media including soil above, laterally adjacent to, and below the pipe; instrument reading of the exterior and interior of the pipe (if breached).

bgs = below ground surface.

7.3.1 Phase 1 Sampling Objective – Pipeline Interior

Description: Determine if waste residue on the interior of the pipeline and/or the pipeline material is contaminated at concentrations above field screening or preliminary clean-up levels. These samples may be waste residue, sludge, scale, or a piece of the pipeline, depending on field conditions. The laboratory samples will be collected at the locations of highest field screening results. A minimum of two laboratory samples per bin will be collected.

The sampling objectives for the tank farm waste-transfer lines include the following.

- Phase 1 data analysis will be used to develop a guide for future pipeline characterization and will compare the use of nondestructive screening techniques to laboratory data.
- Phase 1 data are expected to provide information on worker chemical and radiological exposures associated with pipeline characterization, as well as cost information on characterization screening and pipeline remediation (if warranted). This information will assist in evaluating alternatives.

Sampling Design Specifications

Initial locations identified for biased sampling may be the pipe outfall, in-line access point(s), or another point(s) where contaminated material might be present.

If biased sampling is not performed and the random sample selection process in Phase 1 is used, the sample design process will include assignment of numbers to all of the pipelines in the bin. The assigned numbers will include a bin identifier. Once the candidate pipelines and associated

identification numbers are specified, a random number generator that processes all of the identification numbers developed will be used to pick the potential pipelines to be sampled.

For portions of the pipeline system where no direct access is available, an excavation to expose a section of pipe may be required. When access to the interior of the pipeline is obtained, investigation activities may include visual observations, radiological screening with handheld or deployed detectors, field screening for indicator chemicals, collecting scale or sludge sample(s) (if present), and cutting pipe sections for laboratory analysis.

7.3.2 Phase 1 Sampling Objective – Surrounding Vadose Zone

Description: Determine if the vadose zone soil in contact with and/or adjacent to the pipeline is contaminated at concentrations above preliminary cleanup levels. A minimum of two laboratory samples per pipeline per bin will be collected. Refer to Tables 7-10 and 7-11 for sampling frequency information. For Phase 1, it was determined that two samples will provide an initial indication of contamination levels. The laboratory samples will be collected at the locations of highest field screening results.

Sampling Design Specifications

The pipeline segments selected for collection of soil samples will be based on the process knowledge and operational history of the pipeline. A minimum of two pipelines per bin will be identified for collection of adjacent soil samples. Two probes will be driven at each location, with the option to drive two addition probes. The decision to drive the two additional probes will be based on the results of the first two. The first preference for sampling locations will be at confirmed release points. The second preference will be areas of suspected releases. Suspected locations include ground-stained, sterile, or anomalous vegetation areas above pipelines.

If pipeline segments cannot be identified using the first two preferences, then the segments will be chosen by the random method. For the randomly selected pipeline segments, soil sampling will be conducted at locations where a release(s) is most likely to have occurred. Examples include sharp pipe-bend locations, connection points for dissimilar pipe materials, and changes in pipe size. This specification applies to all bins.

Surface geophysical techniques applicable to identification of subsurface moisture may be used in suspect areas to gather additional data before conducting intrusive activities. Subsurface evaluations to determine contaminant levels will include use of vertical radiological logging and collection of soil samples via boreholes or by excavation.

7.3.3 Phase 1 Investigative Techniques

Table 7-7 summarizes the key features of the investigative techniques or sampling methods that may be used to gather information. Application of these techniques to specific pipelines will be identified in the 200-IS-1 OU Work Plan and the SAP. They are introduced in this DQO to provide a basis for developing the aforementioned plans.

Table 7-8 indicates the general investigation locations and activities identified for the pipeline system bins for Phase 1.

7.4 PHASE 2 DESIGN ASSUMPTIONS AND CHARACTERIZATION OBJECTIVES

The objective Phase 2 of the investigation is to obtain a sufficient amount of data to make remedial action decisions. The Phase 1 results will be used to guide Phase 2. If evaluation of the Phase 1 data indicates the need for Phase 2 characterization, a statistical-based sampling design will be developed using each bin as a decision unit. Modification to the DQO and/or work plan/SAP may be required. Where Phase 2 characterization is needed, the decision errors and data confidence requirements will be reevaluated and revised, as needed.

7.4.1 Phase 2 Sampling Objective – Pipeline Interior

Description: Determine if interior waste residue and/or pipeline material is contaminated at concentrations above action levels.

Sampling Design

A statistical sampling design will be selected and applied to the waste stream pipeline group(s) identified for Phase 2 sampling. General elements of the Phase 2 sampling design are provided here. The number of Phase 2 investigation locations, samples, and analyses will be finalized after review of Phase 1 results, for those waste group decision units where Phase 1 sampling is undertaken. For Phase 2, a separate SAP will be developed.

For the evaluation of the interior of a pipeline, readily available points of access such as manholes and outfalls may be preferentially used. For portions of the pipeline system where no direct access is available, an excavation to expose a section of pipe would be performed. When access to the interior of the pipeline is obtained, investigation activities could include visual observations, camera surveys, radiological screening with handheld or deployed detectors, and collection of scale or sludge samples.

Table 7-8. Potential Phase I Characterization Locations and General Investigation Activities.

Bin	Potential Residual Waste Accumulation or Leak Locations to be Investigated	General Investigation Activities					
		Inside Structure			Soil		
		Visual Inspection	In-Pipe Beta/Gamma/ Alpha Instrument Radiation Survey (Hand-Held and/or Deployed)	Swipe, Smear, Scale, Sediment, and/or Sludge Samples	Geophysical Surveys to Locate Lines and/or for Leak Detection	GeoProbe [a] Holes For Radiological Logging	GeoProbe Hole For Sample Collection
Bins 1-5	Near process facility connection location	X	X	X	X	X	X
	Low points or low gradient section of pipeline (along middle portion of pipeline run if applicable)				X	X	X
	Pipe-bend locations				X	X	X
	Existing access point (e.g., manholes or outfalls)	X	X	X	X	X	X
	Accessible distal end of pipeline system (upstream of buried disposal site)	X	X	X	X	X	X
Tank farm waste-transfer lines	Areas of suspected high-inventory accumulation	X	X	X	X	X	X

[a] GeoProbe is a registered trademark of GeoProbe Systems, Salina, Kansas.

7.4.2 Phase 2 Sampling Objective – Surrounding Soil

Description: Determine if the soil in contact with and adjacent to the pipeline is contaminated at concentrations above preliminary cleanup levels.

Sampling Design

A statistical sampling design will be selected and applied to the waste stream pipeline group(s) that will have a Phase 2 investigation. Specific requirements (e.g., number of samples, sample types, and required analyses) will be identified in the Phase 2 SAP. The general elements of the Phase 2 sampling design are provided here.

Subsurface evaluations will be conducted to gather information concerning constituent concentrations in the soil adjacent to the pipeline. The investigation will include using vertical geophysical logging to gather radiological data and collecting soil samples via boreholes or by excavation.

7.4.3 Phase 2 Investigative Techniques

The key features of the investigative techniques or sampling methods that may to used to gather information were shown in Table 7-7. Application of these techniques to specific pipelines will be identified in the 200-IS-1 OU Work Plan and the SAP developed for Phase 2. They are introduced here to provide a basis for developing the aforementioned plans.

Phase 2 sample design specifications and requirements will be developed after the Phase 1 results have been reviewed.

7.5 DECISION UNITS AND SAMPLING ACTIVITIES FOR PHASE I

Table 7-9 presents the pipeline decision units, based on waste stream composition. General characteristics of each decision unit are provided.

Tables 7-10 and 7-11 present a summary of the sampling design elements for each DS and the potential number of samples and/or measurements to be collected for Phase 1 sampling. Pipelines will be selected from the bins and sample locations identified using a biased selection process (Figure 7-1). Analytical data collected in Phase 1 will be evaluated to determine if pipeline and soil contamination is above or below cleanup levels. A limited number of samples are needed to meet the objectives of Phase 1. This is because, by biasing the sample locations to areas of known or suspected high concentration of contamination, the probability will be increased of detecting and confirming the presence and magnitude of contamination, thus reducing the need for a large sample set. The selected pipeline will be sampled at a minimum at three locations for the pipe interior and at a minimum two locations (2 GeoProbes at each location) for the surrounding soil. The minimum number of samples collected at each location is two. Insufficient sample volumes may occur during interior pipeline sampling. The

prioritization of analyses will be determined based on the bin, process knowledge, and field conditions.

Table 7-9. Pipeline Decision Units Based on Bins.

Decision Unit	Pipeline Attributes		Locations: 200 Areas Facilities that Include the Pipeline Waste Group Decision Unit
	Pipe Material Types Included [a]	Pipe Diameters (in.) [a]	
Process Condensate, Process Waste, and Chemical Laboratory Waste Pipelines	Vitrified clay, stainless steel, corrugated galvanized steel, carbon steel	1, 3, 4, 5, 6, 8, 10, and 16	All
Steam Condensate and Cooling Water Pipelines	Vitrified clay, reinforced concrete, corrugated metal	6, 8, 10, 15, 18, 24, 30, and 36	All
Chemical Sewer Waste Pipelines	Vitrified clay, stainless steel, carbon steel, corrugated metal	3, 8, 12, 14, 15, 36, 42, and 48	All but Hot Semiworks
Miscellaneous Waste Pipelines	Vitrified clay, black steel	4 and 6	All
Tank/Scavenged Waste Pipelines	Stainless steel	2, 3, 10, and 14	B Plant, Hot Semiworks, T Plant, and U Plant
Tank Farms Waste Transfer Pipelines	Carbon steel, stainless steel	2, 3, and 6	All

[a] The pipe materials and diameters listed are based on the current level of review of engineering drawings. This list may be revised as additional information is compiled and evaluated.

Table 7-10. Summary of Potential Number of Nonradiological Investigations and Sampling Activities for the Phase 1 Pipeline System Evaluation.

DS #	Medium	Minimum Number of Pipelines per Bin to be Investigated	Minimum Number of Sampling Locations per Pipeline for Evaluation	Potential Number of Chemical Field Screening Tests or Measurements	Potential Number of Scale, Sediment, or Sludge Samples for Laboratory Analysis	Potential Number of GeoProbe [a] Soil Sample Locations	Minimum Number of Soil Samples for Laboratory Analysis
1	Pipe interior (chemical determination)	2	3	One field test per location per indicator chemical identified in the 200 IS-1 Operable Unit Work Plan (DOE/RL-2002-14)	6	N/A	N/A
2	Surrounding soil (chemical determination)	2	4	Two field tests per location per indicator chemical identified in the 200 IS-1 Operable Unit Work Plan (DOE/RL-2002-14)	N/A	8	8

DOE/RL-2002-14, *Tanks/Lines/Pits/Boxes/Septic Tank and Drain Fields Waste Group Operable Unit RI/FS/Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-IS-1 and 200-ST-1 Operable Units*, Rev. 1, Draft A.

[a] GeoProbe is a registered trademark of GeoProbe Systems, Salina, Kansas.

N/A = not applicable.

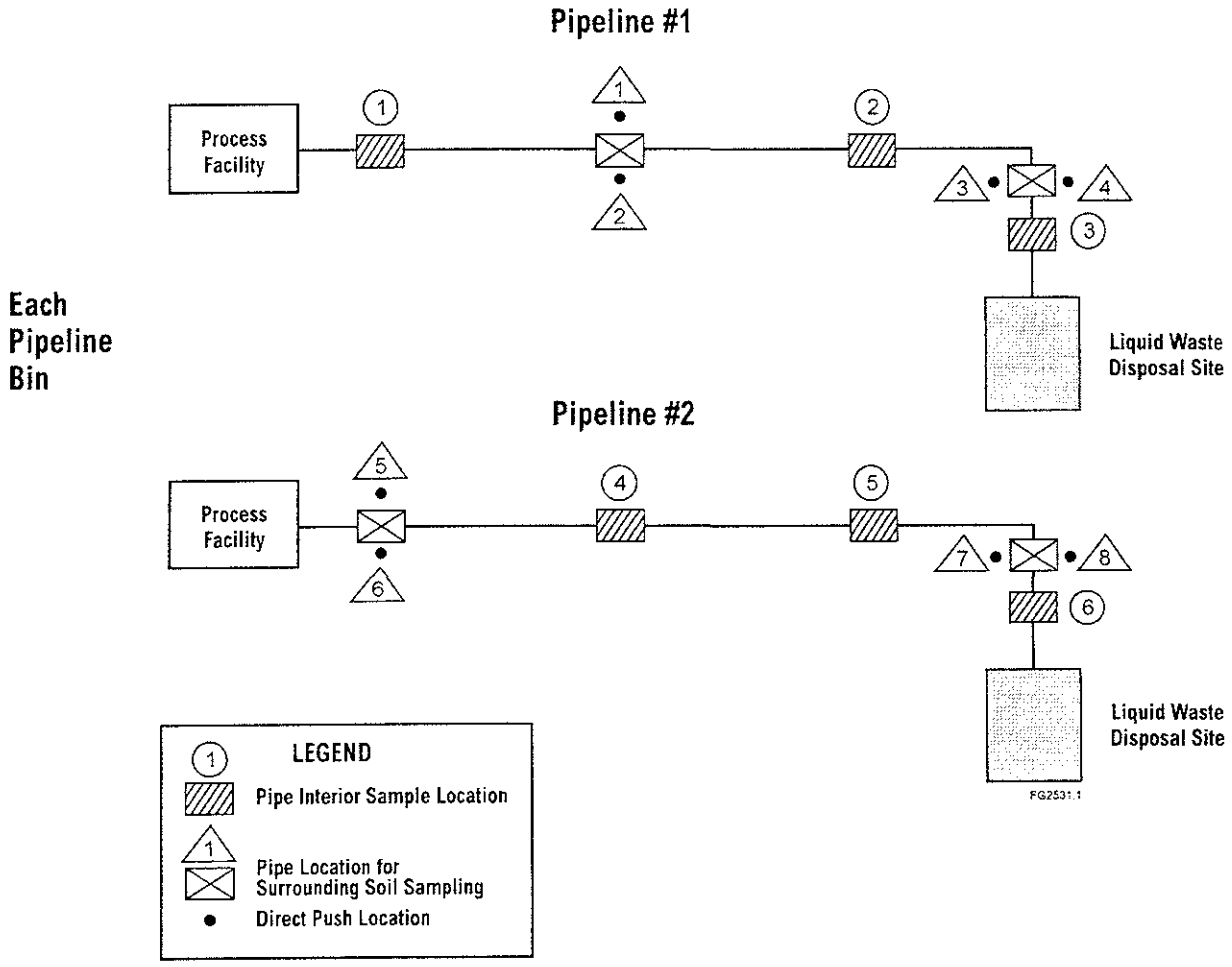
Table 7-11. Summary of Potential Number of Radiological Investigations and Sampling Activities For the Phase 1 Pipeline System Evaluation.

DS #	Medium	Minimum Number of Pipelines per Bin to be Investigated	Minimum Number of Locations per Pipeline for Evaluation	Potential Number of Radiological Instrument Measurements (Includes Hand-Held and/or Deployed Instrumentation)	Number of Smear/Swipe Samples for Screening Radiological Analysis	Potential Number of Scale, Sediment, or Sludge Samples for Laboratory Analysis	Potential Number of Vertical Radiological Geophysical Survey Locations	Minimum Number of Soil Samples for Laboratory Analysis
3	Pipe interior (radiological determination)	2	3	Gather opportunistically, per measurement specifications identified in the 200-IS-1 Operable Unit Work Plan (DOE/RL-2002-14)	Gather opportunistically	6	N/A	N/A
4	Surrounding soil (radiological determination)	2	4	Gather opportunistically, per measurement specifications identified in the 200-IS-1 Operable Unit Work Plan (DOE/RL-2002-14)	N/A	N/A	8	8

DOE/RL-2002-14, Tanks/Lines/Pits/Boxes/Septic Tank and Drain Fields Waste Group Operable Unit RI/FS/Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-IS-1 and 200-ST-1 Operable Units, Rev. 1, Draft A.

N/A = not applicable.

Figure 7-1. General Phase I Sampling Locations.



8.0 REFERENCES

03-ED-009, 2003, "Hanford Facility Dangerous Waste Part A Permit Application Form 3, Revision 8, for the Single-Shell Tank (SST) System," (letter to Michael A. Wilson, Washington State Department of Ecology, from James E. Rasmussen), U.S. Department of Energy, Richland Operations Office, Richland, Washington, January 21. Attachment: *Hanford Facility Dangerous Waste Part A Permit Application Form 3, Revision 8 for the Single-Shell Tank System.*

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Title 10, *Code of Federal Regulations*, Part 61, as amended.

10 CFR 61.55, "Licensing Requirements for Land Disposal of Radioactive Waste," "Waste Classification," Title 10, *Code of Federal Regulations*, Part 61.55, as amended.

10 CFR 834, "Radiation Protection of the Public and the Environment," proposed rule, Title 10, *Code of Federal Regulations*, Part 834, as amended.

10 CFR 835.202, "Occupational Radiation Protection," "Occupational Dose Limits for General Employees," Title 10, *Code of Federal Regulations*, Part 835.202, as amended.

10 CFR 835.208, "Occupational Radiation Protection," "Limits for Members of the Public Entering a Controlled Area," Title 10, *Code of Federal Regulations*, Part 835.202, as amended.

40 CFR 141, "National Primary Drinking Water Regulations," Title 40, *Code of Federal Regulations*, Part 141, as amended.

40 CFR 141.66, "National Primary Drinking Water Regulations," "Maximum Contaminant Levels for Radionuclides," Title 40, *Code of Federal Regulations*, Part 141.66, as amended.

40 CFR 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," Title 40, *Code of Federal Regulations*, Part 191, as amended.

40 CFR 191.12, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," "Definitions," Title 40, *Code of Federal Regulations*, Part 191.12, as amended.

40 CFR 196, "Radiation Site Cleanup Standards," Title 10, *Code of Federal Regulations*, Part 196 (see 58 FR 64474, (advanced notice of proposed rulemaking).

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Title 40, *Code of Federal Regulations*, Part 300, as amended.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List," Title 40, *Code of Federal Regulations*, Part 300, as amended.

40 CFR 300.430(b), "Remedial Investigation/Feasibility Study and Selection of Remedy," "Scoping," Title 40, *Code of Federal Regulations*, Part 300.430(b), as amended.

64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)," *Federal Register*, Vol. 64, No. 218, pp. 61615-61625, November 12, 1999.

ANL, 2002, *RESRAD for Windows*, Version 6.21, Environmental Assessment Division, Argonne National Laboratory, Argonne, Illinois.

ANL, 2003, *RESRAD-BIOTA*, Version 1.0 Software, Argonne National Laboratory, Argonne, Illinois.

ANL, 2006, *RESRAD-BIOTA*, Version 1.2 Software, Argonne National Laboratory, Argonne, Illinois.

ANL/EAD-4, 2001, *User's Manual for RESRAD, Version 6*, Argonne National Laboratory, Environmental Assessment Division, Argonne, Illinois.

ARH-947, 1972, *200 Areas Disposal Sites for Radioactive Liquid Wastes*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-1608, 1970, *Radioactive Contamination in Liquid Wastes Discharged to Ground Within the Chemical Separations Area Control Zone Through 1969*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-1945, 1971, *B Plant Ion Exchange Feed Line Leak*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-2155, 1970, *Radioactive Liquid Waste Disposal Facilities—200 West Area*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-2757, 1973, *Radioactivity in Gaseous Waste Discharged from the Separations Facilities During 1972*, Parts 1 through 4, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-F-101, 1976, *Vacuum Evaporator-Crystallizer Flowsheet for Waste Liquors*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-ST-156, 1977, *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells*, Atlantic Richfield Hanford Company, Richland, Washington.

Best-Basis Inventory, Hanford Site database.

BHI-00033, 1994, *Surface and Near Surface Field Investigation Data Summary Report for the 200-UP-2 Operable Unit*, Bechtel Hanford, Inc., Richland, Washington.

BHI-00034, 1995, *Borehole Summary Report for the 200-UP-2 Operable Unit, 200 West Area*, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI-00174, 1995, *U Plant Aggregate Area Management Study Technical Baseline Report*, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

BHI-00177, 1995, *T Plant Aggregate Area Management Study Technical Baseline Report*, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

BHI-00184, 1995, *Miocene- to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-01119, 2001, *Hanford Site Atlas*, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.

DOE G 435.1-1, 1999, *Implementation Guide for Use with DOE M 435.1-1*, U.S. Department of Energy, Washington, D.C.

DOE/EIS-0222-F, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, U.S. Department of Energy, Washington, D.C.

DOE/RL-91-19, 1993, *RCRA Facility Investigation/Corrective Measures Study Work Plan for the 200-UP-2 Operable Unit, Hanford Site, Richland, Washington*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-52, 1992, *U Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-58, 1992, *Z Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-60, 1992, *S Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-61, 1992, *T Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-04, 1993, *PUREX Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-05, 1993, *B Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-18, 1993, *Semiworks Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-24, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 4, 2 vols., U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-70, 1993, *Phase I Remedial Investigation Report for 200-BP-1 Operable Unit,* Vols. 1 and 2, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-95-13, 1995, *Limited Field Investigation for the 200-UP-2 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-12, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-81, 1997, *Waste Site Grouping for 200 Areas Soil Investigations*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-98-28, 1999, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-99-36, 2000, *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management Areas*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2000-38, 2001, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2000-60, 2004, *Uranium-Rich/General Process Condensate and Process Waste Group Operable Units RI/FS Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-PW-2 and 200-PW-4 Operable Units*, Rev. 1, Reissue, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2001-01, 2004, *Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit RI/FS Work Plan, Includes: 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Rev. 0, Reissue, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2001-54, 2005, *Central Plateau Ecological Evaluation*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2002-14, 2004, *Tanks/Lines/Pits/Boxes/Septic Tank and Drain Fields Waste Group Operable Unit RI/FS/Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-IS-1 and 200-ST-1 Operable Units*, Rev. 1, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-11, 2004, *Remedial Investigation for the 200-CW-5 U Pond/ Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-CS-1 Steam Condensate Group Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2004-39, 2004, *200-UR-1 Unplanned Release Waste Group Operable Unit Remedial Investigation/Feasibility Study Work Plan and Engineering Evaluation/Cost Analysis*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-STD-1153-2002, 2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, DOE Technical Standard, U.S. Department of Energy, Washington, D.C.. Available on the Internet at http://www.eh.doe.gov/techstds/standard/std1153/1153.htm .

Ecology 94-115, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Toxics Cleanup Program, Washington State Department of Ecology, Olympia, Washington.

Ecology 94-145, 2001, *Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulation; CLARC, Version 3.1*, Washington State Department of Ecology, Olympia, Washington (calculations updated January 2006).

Ecology 97-602, 1997, *Analytical Methods for Petroleum Hydrocarbons*, Washington State Department of Ecology, Olympia, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

EPA, 1992, *Supplemental Guidance to RAGS: Calculating the Concentration Term*, OSWER Publication 9285.7-081, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1997, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, OSWER Directive 9200.4-18, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/1-89/002, 1989, *Risk Assessment Guidance for Superfund (RAGS), Volume I -- Human Health Evaluation Manual, (Part A) Interim Final*, OSWER 9285.7-01A, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/G-89/004, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final*, OSWER 9355.3-01, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/4-79/020, 1983, *Methods of Chemical Analysis of Water and Wastes*, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

EPA/600/4-86/024, 1986, *Development of Standard Methods for the Collection and Analysis of Precipitation*, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/4-91/010, 1991, *Methods for the Determination of Metals in Environmental Samples*, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/R-96/055, 2000, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, as amended, U.S. Environmental Protection Agency, Washington, D.C.

EPA/625/R-92/007, 1993, *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: a Reference Guide*, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.

Gilbert, R. O., 1987, *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York, New York.

Hanford Environmental Information System, Hanford Site database.

Hanford Site Drawings:

- H-2-353, *Waste Disposal Cribs, 216-T-6, 216-T-8 Cribs & Reverse Wells 216-T-3 & T-2*
- H-2-432, *Piping Between 241B and 241C*
- H-2-612, *Arrangement & Piping Diversion Box 241-BX-153*
- H-2-618, *Catch Tank Arrangement E.P. 241-BX-302-A*
- H-2-629, *Diversion Box 241-154 BX Piping Conn. To 221-B & 241-BX*
- H-2-635, *Catch Tank Arr'g't. EQ. P.C. 241 BX-302-B*
- H-2-638, *Diversion Box 241-155 BX Arrangement & Piping*
- H-2-840, *Diversion Box Catch Tank & Piping at 241-TX-155*
- H-2-843, *Diversion Box & Piping Layout*
- H-2-939, *Waste Line Arrgt & Details SHT V*
- H-2-1495, *200 West Area Steam Line Plot Plan*

- H-2-2236, *Waste Line Plan & Profile*
- H-2-2536, *Catch Tank and Piping Replacement at Diversion Box 241-TX-155*
- H-2-2537, *241-ER-311 Catch Tk and Piping Replacement at Diversion Box 241-ER-151*
- H-2-4010, *Strontium Semiworks & Vicinity Outside Lines Key Map*
- H-2-4420, *Plot Plan Hot Semiworks Waste Self Concentrator*
- H-2-4535, *Site Plan & Underground Piping Strontium Facilities, Hot Semiworks*
- H-2-32096, *Decontamination Waste Crib Plans & Profiles*
- H-2-32097, *Decontamination Waste Crib Sections & Det.s*
- H-2-32523, *"C" Plant Liquid Waste Disposal Sites, 216 "C" Series*
- H-2-32886, *Promethium Transfer Line Plan, Profile & Detail – Sheet 3*
- H-2-39955, *Structural Compressor House*
- H-2-42383, Sheet 1, *Piping – Booster Pump Pit – Plan and Sections*
- H-2-42390, *Piping – Underground Process Plan & Sections*
- H-2-42391, Sheet 2, *Piping – Underground Process Plan & Sections*
- H-2-42496, *Piping Arrangement – Master Diversion Box – Plan & Elevations*
- H-2-43031, *Abandoned Catch Tank at Diversion Box 241-ER-151 Piping Arrangement*
- H-2-43036, *Diversion Box 241-ER-151 Piping Layout*
- H-2-43108, *9'-0 Dia. x 40' Mild Steel Catch Tank at 241-ER-151*
- H-2-44004, Sheet 1, *216-U-3 Crib Details, 241-U Steam Condenser Water and Drain Piping*
- H-2-44301, Sheet 1, *Plot Plan and Piping*
- H-2-44335, *Outside Lines Key Plan & Details*
- H-2-44356, *Equipment Waste and Process Drains Service & Control Bldg*
- H-2-44501, Sheet 82, *Area Map 200 East "C" Plant Facilities*
- H-2-44511, Sheet 38, *Area Map – 200 West "S" Plant Facilities*
- H-2-44511, Sheet 109, *Area Map 200 West "T" Plant Facilities*

- H-2-44511, Sheet 110, *Area Map 200 West T Plant Facilities*
- H-2-44511, Sheet 118, *Area Map 200 West T Plant Facilities*
- H-2-44511, Sheet 126, *Area Map 200 West T Plant Facilities*
- H-2-44511, Sheet 132, *Area Map 200 West T Plant Facilities*
- H-2-44511, Sheet 134, *Area Map 200 West T Plant Facilities*
- H-2-44511, Sheet 140, *Area Map 200 West "T"-Plant Facilities*
- H-2-56050, Sheet 1, *Underground Rock Cribs 216A-2,A-3,A-4,A-5*
- H-2-71670, *Piping Enlgd Plan & Sect 241-ER-151 & 241-ER-311*
- H-2-72885, *Decontamination Trailer & Radiation Monitoring Tank*
- H-2-95401, Sheets 1 and 2, *Ventilation Upgrade Compressor Bldg.*
- SK-2-2419, *Catch Tank and Piping Replacement at Diversion Box 241-TX-155*
- W-72183, Sheet 3, *Diversion Boxes 241-B-151 and 241-B-152 Arrgt Piping*

HNF-1744, 1999, *Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site*, Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-5507, 2000, *Subsurface Conditions Description of the B-BX-BY Waste Management Area*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-14755, 2004, D*ocumented Safety Analysis for the 242-A Evaporator*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-EP-0924, 1997, *History and Stabilization of the Plutonium Finishing Plant (PFP) Complex, Hanford Site*, Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-HTI-TI-001, 1998, *AX Tank Farm Waste Inventory Study for the Hanford Tanks Initiative Project*, Rev. 0A, Numatec Hanford Corporation, Richland, Washington.

HW-10475, 1944, *Hanford Engineer Works Technical Manual (T/B Plants)*, Parts A, B, and C, General Electric Company, Richland, Washington.

HW-18700-DEL, 1951, *REDOX Technical Manual*, General Electric Company, Richland, Washington.

HW-19140, 1951, *Uranium Recovery Technical Manual*, General Electric Company, Richland, Washington.

HW-31000-DEL, 1955, *PUREX Technical Manual*, General Electric Company, Richland, Washington.

HW-31373, 1954, *PUREX Chemical Flowsheet HW Number 3 Chemical Development Unit Separations Technology Subsection Technical Sec Engineering Department,* General Electric Company, Richland, Washington.

HW-31442, 1954, *Recovery of Cesium-137 from Uranium Recovery Process Wastes*, General Electric Company, Richland, Washington.

HW-31767, 1954, *Hot Semiworks REDOX Studies,* General Electric Company, Richland, Washington.

HW-33305, 1954, *Tabulation of Radioactive Liquid Waste Disposal Facilities*, General Electric Company, Richland, Washington.

HW-52860, 1957, *Standby Status Report Hot Semiworks Facility,* General Electric Company, Richland, Washington.

HW-72666, 1963, *Hot Semi-Works Strontium-90 Recovery Program*, General Electric Company, Richland, Washington.

HWS-5637, 1955, *Specifications for Crib 216-A-8, PUREX Waste Facilities*, General Electric Company, Richland, Washington.

LA-UR-96-3860, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model*, Rev. 4, Los Alamos National Laboratory, Los Alamos, New Mexico.

Metz, W. P., 1972, "PSS Line Leak (Line No. 812)," (letter to G. L. Borshiem from W. P. Metz), Atlantic Richfield Hanford Company, Richland, Washington, November 9.

OUT-1462, 1945, *History of Operations (1 January 1944 to 20 March 1945)*, Hanford Engineer Works, Richland, Washington.

PNL-5506, 1986, *Hanford Site Water Table Changes 1950 through 1980 – Data Observation and Evaluation*, Pacific Northwest Laboratory, Richland, Washington.

PNL-7336, 1990, *Geohydrology of the 218-W-5 Burial Ground, 200 West Area, Hanford Site*, Pacific Northwest Laboratory, Richland, Washington.

PNLATLAS/LG-ARCHV/200 EAST & WEST, Hanford Site Database for Geophysical Logging.

PNNL-11800, 1998, *Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-12028, 2000, *STOMP Subsurface Transport Over Multiple Phases, Version 2.0, Application Guide*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13037, 2000, *Geochemical Data Package for the Hanford Immobilized Low-Activity Tank Waste Performance Assessment (ILAW PA)*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13116, 2000, *Hanford Site Groundwater Monitoring for Fiscal Year 1999*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13788, 2002, *Hanford Site Groundwater Monitoring for Fiscal Year 2001*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13895, 2003, *Hanford Contaminant Distribution Coefficient Database and Users Guide*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington. Available on the Internet at http://www.pnl.gov/main/publications/external/technical_reports/PNNL-13895rev1.pdf .

PNNL-14548, 2004, *Hanford Site Groundwater Monitoring for Fiscal Year 2003*, Pacific Northwest National Laboratory, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

RHO-CD-673, 1979, *Handbook 200 Areas Waste Sites*, 3 vols., Rockwell Hanford Operations, Richland, Washington.

RHO-LD-114, 1981, *Existing Data On the 216-Z Liquid Waste Sites*, Rockwell International, Richland, Washington.

RHO-ST-21, 1978, *Report on Plutonium Mining Activities at 216-Z-9 Enclosed Trench,* Rockwell Hanford Operations, Richland, Washington.

RHO-ST-44, 1982, *216-Z-12 Transuranic Crib Characterization: Operational History and Distribution of Plutonium and Americium*, Rockwell Hanford Operations, Richland, Washington.

RL-SEP-396, 1965, *242-T Evaporator Facility Information Manual*, Hanford Atomic Products Operation, General Electric Company, Richland, Washington.

RL-TPA-90-0001, 1998, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RPP-7123, 2001, *Subsurface Conditions Description of the T-TX-TY Waste Management Area*, Rev. 0, CH2M HILL Hanford Group Inc., Richland, Washington.

RPP-7494, 2001, *Historical Vadose Zone Contamination from A, AX, and C Tank Farm Operations*, prepared by Fluor Federal Services for CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-19822, 2004, *Hanford Defined Waste Model – Revision 5.0*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20604, 2004, *Tank Farm Ancillary Equipment Disposition Study*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20605, 2004, *Cross-Site Transfer System Disposition Study*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-23403, 2005, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-25113, 2005, *Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-26744, 2005, *Hanford Soil Inventory*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

SD-WM-SAR-003, 1984, *The Safety Analysis Report for the Decontamination and Decommissioning of the Strontium Semiworks Complex*, Rockwell Hanford Operations, Richland, Washington.

SW-846, 1999, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available on the Internet at www.epa.gov/SW-846/main.htm .

Tank Waste Information Network System (Tank Characterization Database) (at http://twins.pnl.gov:8001/TCD/ main.html), Lockheed Martin Hanford Corporation, Richland, Washington.

TRAC-0238, 1985, *200 Areas Fact Book*, Rockwell Hanford Operations, Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-303-070, "Designation of Dangerous Waste," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-303-090, "Dangerous Waste Characteristics," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-303-610(2), "Closure and Post-Closure," "Closure Performance Standard," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-700(6)(d), "Overview of Cleanup Standards," "Requirements for Setting Cleanup Levels," "Natural Background and Analytical Considerations," *Washington Administrative Code,* as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-720, "Ground Water Cleanup Standards," *Washington Administrative Code,* as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-720(2), "Ground Water Cleanup Standards," "Potable Ground Water Defined," *Washington Administrative Code,* as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-740, "Unrestricted Land Use Soil Cleanup Standards," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-740(3), "Unrestricted Land Use Soil Cleanup Standards," "Method B Soil Cleanup Levels for Unrestricted Land Use," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-740(3)(b), "Unrestricted Land Use Soil Cleanup Standards," "Method B Soil Cleanup Levels for Unrestricted Land Use," "Standard Method B Soil Cleanup Levels," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-745(5)(b), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels," "Standard Method C Industrial Soil Cleanup Levels," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-747(4), "Deriving Soil Concentrations for Ground Water Protection," "Fixed Parameter Three-Phase Partitioning Model," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-900, "Tables," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

Waste Information Data System Report, Hanford Site database.

WDOH/320-015, 1997, *Hanford Guidance for Radiological Cleanup*, Rev. 1, Washington State Department of Health, Olympia, Washington.

WHC-EP-0172, 1990, *Inventory of Chemicals Used at Hanford Site Production Plants and Support Operations (1944-1980)*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0342, 1990, Addendum 8, *Plutonium Finishing Plant Wastewater Stream-Specific Report,* Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0560, 1992, *Miscellaneous Underground Radioactive Waste Tanks*, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0883, 1995, *Variability and Scaling of Hydraulic Properties for 200 Area Soils, Hanford Site*, Westinghouse Hanford Company, Richland, Washington.

WHC-IP-0809, 1991, *B Plant Aggregate Area Management Study Technical Baseline Report*, Westinghouse Hanford Company, Richland, Washington.

WHC-MR-0227, 1991, *Tank Wastes Discharged Directly to the Soil at the Hanford Site,* Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-ES-019, 1992, *Semiworks Aggregate Area Management Study, Technical Baseline Report*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-TI-014, 1992, *Hydrogeologic Model of the 200 West Groundwater Aggregate Area*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-TI-019, 1992, *Hydrogeologic Model for the 200-East Groundwater Aggregate Area*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-TI-290, 1994, *Geologic Setting of the Low-Level Burial Grounds*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-NR-ER-103, 1993, *Final Report for the Remote CCTV Survey of Abandoned Process Effluent Drain Lines 840 and 840D in Support of the 200 West Area Carbon Tetrachloride ERA*, Rev. 0, Westinghouse Hanford, Inc., Richland, Washington.

WHC-SD-WM-ER-308, 1994, *Supporting Document for the Historical Tank Content Estimate for A Tank Farm*, Rev. 0, ICF Kaiser Hanford Company for Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

APPENDIX A

EXISTING INFORMATION SUMMARY TABLES

TABLES

REFERENCES

80322-88-090, "Surface Contamination Investigation Report, Cross-Country Waste Transfer Line," (internal letter report from R. E. Wheeler to J. C. Bergam), Westinghouse Hanford Company, Richland, Washington.

ARH-1945, 1971, *B Plant Ion Exchange Feed Line Leak*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-1972, *PSS Line Leak* (Line No. 812), included in RHO-CD-673, *Handbook 200 Areas Waste Sites*, as pp.103-106.

ARH-2155, 1970, *Radioactive Liquid Waste Disposal Facilities—200 West Area*, Atlantic Richfield Hanford Company, Richland, Washington.

BHI-00033, 1994, *Surface and Near Surface Field Investigation Data Summary Report for the 200-UP-2 Operable Unit*, Bechtel Hanford, Inc., Richland, Washington.

BHI-00174, 1995, *U Plant Aggregate Area Management Study Technical Baseline Report*, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

DOE/RL-91-60, 1992, *S Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-61, 1992, *T Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-05, 1993, *B Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-95-13, 1995, *Limited Field Investigation for the 200-UP-2 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-99-66, 2003, *Steam Condensate/Cooling Water Waste Group Operable Units RI/FS Work Plan; Includes: 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2000-60, 2004, *Uranium-Rich/General Process Condensate and Process Waste Group Operable Units RI/FS Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-PW-2 and 200-PW-4 Operable Units*, Rev. 1, Reissue, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2001-11, 2004, *Final Feasibility Study for the Canyon Disposition Initiative (221-U Facility)*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2002-69, 2003, *Feasibility Study for the 200-CW-1 and 200-CW-3 Operable Units and the 200 North Area Waste Sites*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-11, 2004, *Remedial Investigation for the 200-CW-5 U Pond/ Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-CS-1 Steam Condensate Group Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

H-2-44511 Series, *Area Map – 200 West Area Facilities*, Hanford Site Drawing.

HW-19140, 1951, *Uranium Recovery Technical Manual*, General Electric Company, Richland, Washington.

HW-52860, 1957, *Standby Status Report Hot Semiworks Facility,* General Electric Company, Richland, Washington.

HW-60807, 1959, *Unconfined Underground Radioactive Waste and Contamination in the 200 Areas - 1959*, General Electric Company, Richland, Washington.

RHO-CD-673, 1979, *Handbook 200 Areas Waste Sites*, 3 vols., Rockwell Hanford Operations, Richland, Washington.

RHO-LD-114, 1981, *Existing Data On the 216-Z Liquid Waste Sites*, Rockwell International, Richland, Washington.

RHO-ST-21, 1978, *Report on Plutonium Mining Activities at 216-Z-9 Enclosed Trench,* Rockwell Hanford Operations, Richland, Washington.

RHO-ST-44, 1982, *216-Z-12 Transuranic Crib Characterization: Operational History and Distribution of Plutonium and Americium*, Rockwell Hanford Operations, Richland, Washington.

RPP-16608, 2004, *Site-Specific Single Shell Tank Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan Addendum for Waste Management Areas C, A-AX, and U*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20604, 2004, *Tank Farm Ancillary Equipment Disposition Study*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20605, 2004, *Cross-Site Transfer System Disposition Study*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-6072, 2000, *Site-Specific SST Phase 1 RFI/CMS Work Plan Addendum for WMA B-BX-BY*, Rev. 1, CH2M HILL Hanford Group Inc., Richland, Washington.

WHC-EP-0342, 1990, Addendum 12, *PUREX Plant Process Condensate Stream-Specific Report*, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0342, 1990, Addendum 14, *PUREX Plant Ammonia Scrubber Condensate Stream-Specific Report*, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0342, 1990, Addendum 19, *UO_3 Plant Process Condensate Stream-Specific Report*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-NR-ER-103, 1993, *Final Report for the Remote CCTV Survey of Abandoned Process Effluent Drain Lines 840 and 840D in Support of the 200 West Area Carbon Tetrachloride ERA*, Rev. 0, Westinghouse Hanford, Inc., Richland, Washington.

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	Millimeters	millimeters	0.039	inches
inches	2.54	Centimeters	centimeters	0.394	inches
feet	0.305	Meters	meters	3.281	feet
yards	0.914	Meters	meters	1.094	yards
miles	1.609	Kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	Hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	Grams	grams	0.035	ounces
pounds	0.454	Kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	Milliliters	milliliters	0.033	fluid ounces
tablespoons	15	Milliliters	liters	2.1	pints
fluid ounces	30	Milliliters	liters	1.057	quarts
cups	0.24	Liters	liters	0.264	gallons
pints	0.47	Liters	cubic meters	35.315	cubic feet
quarts	0.95	Liters	cubic meters	1.308	cubic yards
gallons	3.8	Liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	Millibecquerel	millibecquerel	0.027	picocuries

APPENDIX A

EXISTING INFORMATION SUMMARY TABLES

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
PW-1	216-Z-1, 216-Z-2, 216-Z-3, & 216-Z-1A	11	Provides data for the effluent pipeline from Z Plant (234-Z5, 236-Z, & 242-Z Buildings) into the 216- Z-2 Crib, and between the 216-Z-2 and 216-Z-1 Cribs (pp. 13-14) and summary of existing data for 216-Z-1 & 2 Cribs and Tile Field. Also 216-Z-3 overflow into 216-Z-1A Tile Field (p. 24).	8-in. SS into Crib (p. 13); 8-in. VCP from 216-Z-3 into tile field (p. 24)	not specified	not specified	acidic process, analytical, and development lab wastes; aqueous and organic waste; uranium waste (pp. 14-15)	1 and possible 3	none	none	none	previous waste site inventory, scintillation probe, and groundwater sampling data summarized (pp. 18-20, 22); previous Crib Plutonium/Americium sampling results summarized (p. 23)	SS may degrade at low pH. Process used oxalic acid, which breaks down into chelans.
	216-Z-1A & 216-Z-3		Provides data for the effluent pipeline from the 234-Z5 Building via the 241-Z-361 Settling Tank into the 216-Z-3 Crib (p. 24) and summary of existing data for 216-Z-3 Crib. Overflow into 216-Z-1A Tile Field (p. 24)	8-in. VCP (p. 24)	not specified	not specified	neutral/basic process, analytical, and development lab wastes (p. 25); low-salt (Ref. 13, p. 6)	4	none	none	none	previous waste site inventory and scintillation probe data summarized (pp.28-29)	none
	216-Z-9	11	Provides data for the RECUPLEX effluent pipeline from the 234-5Z Building into the 216-Z-9 Trench (pp. 52-53) and summary of existing data for the 216-Z-9 Trench.	not specified	not specified	not specified	acidic, aqueous and organic waste; high salt	1,2,4	none	none	none	previous waste site inventory, scintillation probe, and well groundwater sampling data summarized (pp.53, 57, 60-61)	RECUPLEX estimates on p. 61.
		12	Provides data for the pipelines from the RECUPLEX Facility in 234-5 Z Plant to the 216-Z-9 Trench.	Two 3.8-cm SS lines; one served as a spare (p. 1)	< 20 ft bgs, because trench depth was 20 ft (p. 1)	not specified	high salt content and acidic (containing aluminum, magnesium, calcium, and other metal nitrate salt waste, degraded solvents) (p. 1)	1,2	none	none	none	summary of 1973 study of plutonium distribution in the 216-Z-9 Trench, which later was mined and 58 kg of plutonium was removed (pp. 4-5).	SS may degrade at low pH and high heat.
		19	Provides summary of existing data for the lines out to the 216-Z-9 Crib.	1.5-in. Schedule 40 SS	not specified	not specified	not specified	1,2,4	none	none	none	none	none
	216-Z-12	13	Provides data for the pipelines from the Z Plant 234-Z, 232-Z, 236-Z, 242-Z, and RECUPLEX processes to 216-Z-12 Crib and summary of existing data for the 216-Z-12 Crib (pp. 16, 18, and 20)	4-in. VCP connected to 12-in. VCP; sections butted together but not sealed (p. 16)	17 ft (p. 16, Fig. 8)	not specified	Low salt, slightly basic (pH ~8), aqueous plutonium-bearing lab and process waste containing sodium, fluoride, and nitrate (p. 1).	4	none	none	none	previous waste site investigations summarized (pp.33-50)	waste from Z-Plant process and labs drained to 241-Z Waste Storage Tanks, then (after neutralized) to 241-Z-361 Settling Tank, with overflow to 216-Z-12 Crib via Diversion Boxes 1 then 2 (pp. 16 & 18).
		11	Provides data for the effluent pipelines from the 241-Z Neutralization Tank via 241-Z-361 Settling Tank to the 216-Z-12 Crib (p. 68) and summary of existing data for 216-Z-12 Crib.	not specified	not specified	not specified	slightly acidic, low salt process waste (p. 68)	4	none	none	none	previous waste site inventory, scintillation probe, and well groundwater sampling data summarized (pp.71, 74-75)	none
	216-Z-18	11	Provides data for the effluent pipeline from the 236-Z and 242-Z Buildings into the 216-Z-18 Crib (p. 92) and summary of existing data for the 216-Z-18 Crib.	not specified	not specified	not specified	acidic, high salt waste (p. 92)	1,2	none	none	none	previous waste site inventory, scintillation probe, and well groundwater sampling data summarized (pp.95, 98-99)	none
PW-2	216-A-10	7	Provides existing data for the 216-A-10 Crib; mention of associated piping.	8-in. VCP; replaced in 1962 with 8-in. SS (2.2.3.5)	not specified	Leaks suspected since acidic waste destroyed VCP integrity (2.2.3.5)	PUREX acidic process condensate, acidic process distillate (D002), and corrosive/mixed waste (D002) process distillate (2.2.3.5) containing uranium and nitrate (Table 2-1).	1 and possible 3	none	none	none	previous waste site radionuclide inventory, sampling and logging results, and soil/ vegetation contaminant concentrations summarized (2.2.3.5, 3.3.1.5, and Tables 3-4 and 3-5).	In 1987, waste stream diverted to 216-A-45 Crib --- See Ref. 16 for waste stream effluent samples before discharge to the crib. Process used oxalic acid, which breaks down into chelans.

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
PW-2	216-B-12	7	Provides existing data for the 216-B-12 Crib; mention of associated piping from 221-U, 224-U and 221-B Buildings (2.2.3.2) into the 216-B-12 Crib.	6-in. VCP (2.2.3.2)	not specified	not specified	low salt, neutral/basic process condensate including limestone (2.2.3.2); neutral to basic, low salt, containing large amounts of uranium, fission products and tributyl phosphate (Table 2-1)	4	none	none	none	previous waste site radionuclide inventory and logging results summarized (2.2.3.2 and 3.3.1.2).	Operated from 1957 to 1973
	216-A-36B	7	Provides existing data for the 216-A-36B Crib; mention of associated piping from 202-A (PUREX) to the 216-A-36B Crib (southern 500 ft of original 216-B-36 Crib).	not specified	not specified	not specified	ammonia scrubber distillate waste (2.2.3.6); neutral to basic, low salt, containing large amounts of uranium (Table 2-1)	4 and possible 2	none	none	none	previous waste site sampling and logging results, and soil/ vegetation contaminant concentrations summarized (2.2.3.2, 3.3.1.6, and Tables 3-4 and 3-5).	See Ref. 17 for waste stream effluent samples before discharge to the 216-A-36B Crib Process used NaOH to scrub NH_3; aqueous NH_3 is basic.
		17	Provides waste stream characterization data for PUREX ammonia scrubber condensate that flowed into storage tanks in 1990; flowed into 216-A-36-B Crib until 1987 (p. v).	not specified	not specified	not specified	contains ammonia (p. 2-8)	not specified	none	none	none	four waste stream samples taken (p. 3-1); results reported in Tables 3-2 to 3-5.	none
PW-2 & PW-4	216-A-10 & 216-A-45	16	Provides waste stream characterization data for PUREX process condensate wastewater stream flow to the 216-A-45 Crib; flowed to 216-A-10 Crib until 1987 (p. 1-4).	not specified	not specified	not specified	process condensate	1	none	none	none	eight waste stream samples taken in 1990 (p. 3-1); results reported in Table 3-2 to 3-6.	Note: diverted waste stream from 216-A-10 Crib to the 216-A-45 Crib in 1987 (p. 1-4)
PW-4	216-S-22	25	Provides information on the 216-S-22 Crib; mentions associated piping from 293-S acid recovery facility (p. 2-16).	4-in.VCP (p. 2-16)	7 ft (p. 2-16)	none mentioned	liquid waste containing nitrate and sodium (p. 2-16)	likely 1	none	none	none	none	Acid recovery process generated acidic waste.
	216-A-37-1	7	Provides existing data for the 216-A-37-1 Crib; mention of associated piping from 242-A Evaporator to the 216-A-37-1 Crib.	not specified	not specified	not specified	Process condensate (2.2.3.8) containing ammonia and mixed waste from solvents (Table 2-1).	2,4	none	none	none	results summarized for logging of groundwater wells near waste site; additional data in Section 3.3.1.8.	Process knowledge: waste thought to contain Am-241, Cs-137, H-3, I-129, Pm-147, Pu-239, Ru-106, Sn-113, and Sr-90 (2.2.3.8).
PW-5	216-B-11A & 216-B-11B	24	Provides information on the 216-B-11A and 216-B-11B Reverse Wells; mentions associated pipeline from the 242-B Evaporator (p. 2-31).	3-in. steel (p. 2-31)	not specified	not specified	low salt, neutral to basic process condensate (p. 2-31)	4	none	none	none	waste contained Cs-137, Ru-106, Sr-90, plutonium, and uranium; "these two wells are placed... in line with a 7.6 cm (3-in) steel inlet pipe" (p. 2-31)	none
PW-6	216-Z-4	11	Provides data for the effluent pipeline from the 231-Z Building into the 216-Z-4 Trench (p. 30) and summary of existing data for 216-Z-4 Trench.	not specified	not specified	not specified	neutral/basic process and lab waste (p. 30)	4	none	none	none	previous waste site radionuclide inventory data summarized (p. 31)	none
	216-Z-5		Provides data for the effluent pipeline from the 231-Z Building into the 216-Z-5 Crib (p. 32) and summary of existing data for 216-Z-5 Crib. Pipeline also may have received 300 Area laboratory wastes (p. 33).	3-in. SS (p. 32)	~ 11 ft	not specified	process waste (p. 32); possibly 300 Area laboratory waste (p. 33)	possible 1	none	none	none	previous waste site radionuclide inventory, scintillation probe, and well groundwater sampling data summarized (pp.35-36)	Process solutions were low pH.
	216-Z-6		Provides data for the effluent pipeline from the 231-Z Building, via the 231-W-151 Sump Tank into the 216-Z-6 Crib (p. 37) and summary of existing data for the 216-Z-6 Crib.	3-in. iron (p. 37)	not specified	not specified	neutral/basic process waste (pp. 38)	4	none	none	none	previous waste site radionuclide inventory data summarized (p. 40)	none
	216-Z-8		Provides data for the effluent pipeline from the 234-5Z Building, via the overflow from the storage tank, into the 216-Z-8 French Drain (p. 49) and summary of existing data for 216-Z-8 French Drain.	4-in. steel (p. 49)	not specified	not specified	neutral/ basic recuplex filter backflush	4	none	none	none	previous waste site radionuclide inventory data summarized (p. 51)	none
	216-Z-10		Provides data for the effluent pipelines from the 231-Z Building into the 216-Z-10 Reverse Well (p. 62) and summary of existing data for the 216-Z-10 Reverse Well.	three 3-in. pipes (p. 62)	5, 6, and 7 ft (p. 62)	not specified	neutral/ basic process and laboratory waste (p. 62)	4	none	none	none	previous waste site inventory reported as 50 g of plutonium; no other radionuclides reported (pp. 62, 64).	

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
SC-1	216-T-36	6	Includes limited information on the pipeline carrying steam condensate from the 221-T and 221-U Buildings and from 2706-T Building decontamination into the 216-T-36 Crib.	not specified	15 ft or less (because the crib depth is 15 ft bgs) (Table 2-4)	not specified	Steam condensate, decontamination waste, and miscellaneous waste (Table 2-4)	2,4	none	none	none	previous waste site radionuclide inventory data/ditch information reported (Table C-4, p. C-35/C-36).	The majority of T Plant decontamination wastes were basic. A few were acidic.
CW-1	207-B	24	Provides information on the waste pipeline from the 242-B Evaporator to the 207-B Retention Basin (p. 2-58).	4-in. cast iron (p. 2-58)	not specified	5 leaks in 1953, UN-200-E-79 (p. 2-58)	not specified	4	none	none	Unplanned release occurred when five leaks were detected in the pipeline in June 1953; up to 2,500 cpm detected at points of emission (p. 2-58)	none	none
		9	Provides data for the 200-E-112 Pipeline, which consists of two process sewer lines (2904-E-1 and 2904-E-2) that carried B Plant water to the 207-B Retention Basin (Table 2-6).	2904-E-1 is 24-in. VCP; 2904-E-2 is 15-in. VCP	not specified	not specified for 2904-E-1; 2904-E-2 found leaking in 1985 (Table 2-6)	two process sewer waste (Table 2-6)	4	none	none	none	none	A portion of the 2904-E-2 Pipeline was found to be leaking and was repaired in 1985; operated from 1944 to 1997 (Table 2-6).
	207-B, 216-B-3 & B Ponds	9	Provides data for the 200-E-126 Pipeline, which extends eastward from the 207-B Retention Basin to the 216-B-3 Ditch and B Pond System (Table 2-6).	24-in. to 30-in. corrugated metal, except one connector section (36-in. diameter) made of high density polyethylene	not specified	Leaks inferred in Table 2-6	not specified	1,4	none	none	none	none	Operated from 1945 to 1997 (Table 2-6) Received PUREX effluent, which was 1 or 4 waste type.
	216-B-3 & B Pond System		Provides data for the 200-E-126 Pipeline, which extends eastward from the 207-B Retention Basin to the 216-B-3 Ditch and B Pond System (Table 2-6).	24-in. to 30-in. corrugated metal, except one connector section (36-in.diam) made of high-density polyethylene	not specified	Leaks inferred in Table 2-6	not specified	1,4	none	none	none	none	Operated from 1945 to 1997 (Table 2-6). Received PUREX effluent, which was 1 or 4 waste type.
CW-1	241-B-154 Diversion Box & 207-B Retention Basin	24	Provides information on the 221-B Building cooling water pipeline to the 241-B-154 Diversion Box, then to the 207-B Retention Basin (pp. 2-59 to 2-60).	24-in.cast iron, 24-in.VCP (p. 2-60)	not specified	1946 (UN-200-E -80) and 1966 (UN-200-E-1) leaks (p. 2-59)	not specified	4	none	none	metal waste leaked from pipeline in 1946, containing ~10 Ci fission products; 1966 leak apparently contained similar waste liquid (p. 2-59)	none	none
CW-5	Z Ditches	5	Includes characterization of pipeline from the 231-Z Building to the Z Ditches.	18-in.VCP (2.1.5)	not specified	Leakage suspected (2.1.5)	Cooling water, steam condensate, and laboratory waste (Ref. 6, 3.3.2.1)	4	Remote video (2.1.5)	none	One smear sample collected from pipe interior; analyzed for 17 rad analytes (2.1.5, 3.2.2); detected 23.5 pCi Pu-238, 1210 pCi Pu-239, 226 pCi and 813 pCi Am-241; 14 radionuclides undetected (Appendix C).	none	216-Z-11 may be difficult to distinguish because ditches overlap; several sources discharged to the 216-Z-11 Ditch (Fig. 2-4 and from Ref. 6: Figure 2-9 and Section 3.3.2).
			Includes characterization of pipeline from the 234-5 Building to the Z Ditches.	15-in.VCP (2.1.5)	not specified	Leakage suspected (2.1.5)	Cooling water and steam condensate; assumed to contain plutonium and other transuranic elements (Ref. 6, 3.3.2.1)	not specified	Remote video (2.1.5)	none	One smear sample collected from pipe interior; analyzed for 17 rad analytes (2.1.5, 3.2.2); detected 2.45 pCi Pu-238, 94.6 pCi Pu-239, 19.5 pCi and 23.5 pCi Am-241; 14 radionuclides undetected (Appendix C).	none	216-Z-11 may be difficult to distinguish because ditches overlap; several sources discharged to the 216-Z-11 Ditch (Fig. 2-4 and from Ref. #6: Figure 2-9 and Section 3.3.2).

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
CW-5	216-U-14	6	Includes limited information on pipeline carrying process sewer waste from the 221-U and 271-U Buildings into the 216-U-14 Ditch.	18-in. VCP (2.2.2.2, 3.3.1.1)	4 ft or less (because ditch depth is 4 ft bgs) (Table 2-1)	not specified	Chemical sewer wastewater, steam condensate, and cooling water (3.3.1.1)	not specified	none	none	none	Previous waste site sampling information reported (Tables 3-1 to 3-4) and summarized (3.3.1.2).	The 216-U-14 Ditch is a representative waste site characterized in Ref. #5. Several pipelines from different sources carried waste to the 216-U-14 Ditch (2.2.2.2, 3.3.1.1, Table 2-9).
	216-Z-20	27	Provides information on the 216-Z-20 Crib; mentions associated piping from the Z Plant (pp. 8-8 and 8-9).	18-in.VCP (p. 8-9)	not specified	not specified	cooling water, steam condensate, storm sewer, building drain, chemical drains, lab drains, and miscellaneous drain waste (p. 8-8)	1,4	none	none	none	none	Crib is classified as a low-level waste site (p. 8-8). Chemical drain would convey acidic wastes.
			Provides information on the 216-Z-20 Crib; mentions associated piping from the Z Plant (pp. 8-8 and 8-9).	15-in.VCP (p. 8-9)	not specified	not specified	cooling water, steam condensate, storm sewer, building drain, chemical drains, lab drains, and miscellaneous drain waste (p. 8-8)	not specified	none	none	none	none	Crib is classified as a low-level waste site (p. 8-8). Chemical drain would convey acidic wastes.
LW-1	216-T-28	26	Provides information on the 216-T-28 Crib; mentions associated piping from the 221-T Buildings, 2706-T Building and 300 Area lab waste from the 340 Building (pp. 2-17 & 2-18).	14-in.steel reducing to 10-in.steel (p. 2-17)	8 ft (p. 2-17)	not specified	liquid mixed waste containing nitrate; steam condensate decon. waste, misc. effluent, decon. waste, and laboratory waste (pp. 2-17 to 2-18)	2,4	none	none	none	none	Many of the decontamination wastes at T Plant were basic.
LW-2	216-Z-7	11	Provides data for the effluent pipeline from the 231-Z Building, via the 231-W-151 Sump Tank, into the 216-Z-7 Crib (p. 42) and summary of existing data for the 216-Z-7 Crib. Also 300 Area laboratory waste from the 340 Waste Neutralization Facility (p. 42).	3-in.iron (p. 41)	not specified	not specified	231-Z process, laboratory, and operations waste; 300 Area laboratory waste (p. 42).	4	none	none	none	Previous waste site inventory, scintillation probe, and well groundwater sampling data summarized (pp.45, 47-48)	none
	216-Z-16		Provides data for the effluent pipeline from the 231-Z Building into the 216-Z-16 Crib (p. 82) and summary of existing data for the 216-Z-16 Crib.	not specified	not specified	not specified	neutral/basic Pacific Northwest Laboratory operations waste (p. 82)	4	none	none	none	Previous waste site inventory, scintillation probe, and well groundwater sampling data summarized (pp.85-86)	none
	216-Z-17		Provides data for the effluent pipeline from 231-Z Building into the 216-Z-17 Trench (p. 87) and summary of existing data for 216-Z-17 Trench.	3-in. schedule 40 carbon steel (p. 87)	not specified	not specified	neutral/basic Pacific Northwest Laboratory operations waste (p. 87)	4	none	none	none	previous waste site radionuclide inventory data summarized (pp.85-86, 90)	none
MW-1	216-Z-13	11	Provides data for the effluent pipeline from the 291-Z Building into the 216-Z-13 French Drain (p. 76) and summary of existing data for the 216-Z-13 French Drain.	4-in.pipe (p. 76)	~ 14 ft	not specified	ET-8 exhaust fan steam condensate and floor drainage (p. 76)	4	none	none	none	none	Radionuclide content is unknown; low levels are assumed (p. 76)
	216-Z-14		Provides data for the effluent pipeline from the 291-Z Building into the 216-Z-14 French Drain (p. 78) and summary of existing data for the 216-Z-14 French Drain.	4-in.pipe (p. 78)	~ 14 ft	not specified	ET-9 exhaust fan steam condensate (p. 78)	4	none	none	none	none	Radionuclide content is unknown; low levels are assumed (p. 78)
	216-Z-15		Provides data for the effluent pipeline from the 291-Z Building into the 216-Z-15 French Drain (p. 80) and summary of existing data for the 216-Z-15 French Drain.	4-in.pipe (p. 80)	~ 14 ft	not specified	S-12 evaporator cooler drainage (p. 80)	4	none	none	none	none	Radionuclide content is unknown; low levels are assumed (p. 80)
	216-U-7	27	Provides information on the 216-U-7 French Drain; mentions associated piping from the 221-U Counting Box (p. 9-7).	3-in.schedule 40 steel (p. 9-7)	13 ft (p. 9-7)	not specified	liquid waste from counting box floor drain (p. 9-7)	not specified	none	none	none	Appendix B shows radionuclide inventory and hazardous chemical inventory	none

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
TW-1	200-E-114 Pipeline	14	Develops conceptual approach to closure of ancillary equipment (pipelines, Diversion Boxes, and similar structures) based on C Tank Farm (p. ES-1); includes limited information on the 200-E-114 Pipeline.	Two 4-in. steel lines (p. 2-20)	not specified	Leak suspected – unplanned release site (p. 2-19)	not specified	possible 2	none	none	none	none	Used for transfer of tank farm liquid waste, which was basic.
	216-B-14	24	Provides information on the 216-B-14 Crib; mentions associated pipeline from 221-U Building (p. 2-20).	14-in.steel (p. 2-20)	not specified	not specified	high salt, neutral/basic scavenged tributyl phosphate waste (p. 2-20)	2	none	none	none	Waste contained Cs-137, Ru-106, Sr-90, plutonium, uranium, ferrocyanide, nitrate, phosphate, sodium, sulfate-based compounds (p. 2-20)	none
TW-1	216-B-15		Provides information on the 216-B-15 Crib; mentions associated pipeline from 221-U Building (p. 2-21).	14-in.steel (p. 2-21)	6 ft (p. 2-21)	not specified	high salt, neutral/basic scavenged tributyl phosphate waste (p. 2-21)	2	none	none	none	Waste contained Cs-137, Ru-106, Sr-90, plutonium, uranium, ferrocyanide, nitrate, phosphate, sodium, and sulfate-based compounds (p. 2-21)	none
	216-B-16		Provides information on the 216-B-16 Crib; mentions associated pipeline from 221-U Building (pp. 2-21 and 2-22).	14-in.steel (p. 2-21)	6 ft (p. 2-21)	not specified	high salt, neutral/basic scavenged tributyl phosphate waste (p. 2-22)	2	none	none	none	Waste contained Cs-137, Ru-106, Sr-90, plutonium, uranium, ferrocyanide, nitrate, phosphate, sodium, and sulfate-based compounds (p. 2-22)	none
	216-B-17		Provides information on the 216-B-17 Crib; mentions associated pipeline from 221-U Building (p. 2-22).	14-in.steel (p. 2-22)	6 ft (p. 2-22)	not specified	high salt, neutral/basic scavenged tributyl phosphate waste (p. 2-22)	2	none	none	none	Waste contained Cs-137, Ru-106, Sr-90, plutonium, uranium, ferrocyanide, nitrate, phosphate, sodium, and sulfate-based compounds (p. 2-22)	none
	216-B-18		Provides information on the 216-B-18 Crib; mentions associated pipeline from 221-U Building (p. 2-22).	14-in.steel (p. 2-22)	6 ft (p. 2-22)	not specified	high salt, neutral/basic scavenged tributyl phosphate waste (p. 2-22)	2	none	none	none	Waste contained Cs-137, Ru-106, Sr-90, plutonium, uranium, ferrocyanide, nitrate, phosphate, sodium, and sulfate-based compounds (p. 2-22)	none
	216-B-19		Provides information on the 216-B-19 Crib; mentions associated pipeline from 221-U Building (p. 2-23).	14-in.steel (p. 2-23)	6 ft (p. 2-23)	not specified	high salt, neutral/basic scavenged tributyl phosphate waste (p. 2-23)	2	none	none	none	Waste contained Cs-137, Ru-106, Sr-90, plutonium, uranium, ferrocyanide, nitrate, phosphate, sodium, and sulfate-based compounds (p. 2-23)	none
	216-T-18	26	Provides information on the 216-T-18 Crib; mentions associated piping from 221-T Building (p. 2-15).	14-in.steel reducing to 10-in.steel (p. 2-15)	8 ft (p. 2-15)	not specified	first-cycle scavenged tributyl phosphate supernatant wastes (p. 2-15)	not specified	none	none	none	none	Mentions "above-ground piping was removed…at completion of discharge" (p. 2-15); reference to inlet pipeline?
	216-T-26		Provides information on the 216-T-26 Crib; mentions associated piping from the T Plant (pp. 2-16 and 2-17).	14-in.steel reducing to 10-in.steel (p. 2-16)	9 ft (p. 2-16)	not specified	first-cycle scavenged tributyl phosphate supernatant wastes; mixed waste containing ferrocyanide and other inorganics (pp. 2-16 to 2-17)	not specified	none	none	none	none	none
TW-2	216-B-7A & 216-B-7B	24	Provides information on the 216-B-7A and 216-B-7B Cribs; mentions associated piping (pp. 2-16 to 2-17).	3-in.steel (p. 2-16)	not specified	not specified	1946-1961, low salt, alkaline rad waste from B Plant; 1961-1967, decon. construction waste from 221-B Bldg. (p. 2-17)	4	none	none	none	Waste contained Cs-137, Ru-106, Sr-90, plutonium, uranium, and transuranic waste (p. 2-17).	One pipeline supplied both cribs simultaneously (p. 2-16)

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
TW-2	216-B-9	24	Provides information on the waste pipeline from the 221-B Building to the 216-B-9 Crib (pp. 2-58 to 2-59).	3.5-in.SS, unencased (p. 2-59)	7 ft (p. 2-59)	1954 leak, UN-200-E-7 (p. 2-58)	not specified	likely 1	none	none	Unplanned release occurred when a leak developed in the waste line; 1.7 rem/h contamination (p. 2-58)	none	WIDS associates leak with 241-B-361 Settling Tank (see discussion on pp.2-58 to 2-59); monitoring well 299-E28-54 is very close to leak location (p. 2-59). This crib was designed for 1st cycle precipitation waste, which was acidic.
IS-1	Cross-site transfer pipes (241-UX-154 & 241-ER-151)	15	Provides information on the cross-site transfer pipelines, between 241-UX-154 Diversion Box and 241-ER-151 Diversion Box (p. ES-1); UPR-600-20 is associated with the cross-site transfer system (2-1, 2-3).	Six 3-in. type 347 SS lines in steel-reinforced concrete containment structure (pp. ES-1, 2-2)	5 ft to 15 ft (p. 2-2)	4 of 6 plugged (ES-1)	high- and low-level radioactive waste; liquid waste for evaporative concentration (2-1)	2	none	To characterize the integrity of the pipeline, eight boreholes were auger drilled at 4 locations along the transfer line in 1988 (2-5).	"No contamination was found below the encasement, but contamination was found in adjacent sagebrush, indicating that the roots had penetrated the encasement" (2-5). NOTE: In May 1995, the U.S. Department of Energy tested one of the remaining lines using pressurized water; results showed the line was intact. It was used to transfer supernatant from double-shell tank 241-SY-102 to the 200 Areas in August 1995 (p. 2-1).	none	UPR-600-20 consists of contaminated pipeline and encasement, any subsurface leaks, associated surface speck contamination, and contaminated vegetation on the surface of the cross-site transfer line. The surface above the pipeline became contaminated through biological transport of radioactive materials that leaked in the pipeline encasement and windblown particulates from the vent station (2-5). Waste was adjusted to high pH before transfer.
		28	Provides information on investigation along the cross-site transfer pipelines between 241-UX-154 Diversion Box and 241-ER-151 Diversion Box (p. 2)	Six 3-in. internal diameter schedule 10S type 347 SS lines in steel-reinforced concrete encasement (p. 2)	5 ft to 15 ft (p. 2)	not specified	not specified	2	none	Soil samples from 8 auger holes at 4 locations along the pipeline (p. 8)	Soils near the encasement were free from contamination (p. 11); radiation found in adjacent sagebrush indicates that the roots have penetrated the encasement; caps have been left off swab risers during sampling, which could account for some contamination near risers (p. 14). Additional results on p. 12.	Soil surveys and analysis of vegetation, animals, and feces in June 1988 to determine if encasement was leaking (pp. 5, 8, and 11).	Associated with tank farm waste, which was high pH.
	241-BX-154 Diversion Box	24	Provides information on two waste pipelines (V335 and V336) from the 221-B Building to the 241-BX-154 Diversion Box (p. 2-59).	unencased (p. 2-59)	3.5 ft (p. 2-59)	1951 (UN-200-E-3) and 1972 (UN-200-E-85) leaks (p. 2-59)	not specified	2,4	none	none	Pipeline was not repaired after 1951 leak, because readings of 120 rem/h were detected with 46 cm (18 in.) of soil remaining (p. 2-59).	none	Associated with tank farm waste, which was high pH.
IS-1	241-BX-154 Diversion Box	24	Provides information on two steam condensate waste pipelines (V200 and V334) from sections 10 and 9, respectively, of the B Plant Concentrator (221-B Bldg) to the 241-BX-154 Diversion Box (p. 2-59).	3.5-n SS (p. 2-59)	~12 ft (p. 2-59)	Two 1972 leaks, UN-200-E-103 and UN-200-E-44 (p. 2-59)	not specified	2,4	none	none	Second leak probably resulted from failure of repairs made after the first leak (p. 2-59).	none	Associated with tank farm waste, which was high pH.
	200-E-111 Pipeline	14	Develops conceptual approach to closure of ancillary equipment (pipelines, Diversion Boxes, and similar structures) based on C tank farm (ES-1): includes limited information on the 200-E-111 pipeline.	Three 3-in. SS lines numbered V108, 8618, and 8653 (p. 2-19)	not specified	Leak suspected – unplanned release site (p. 2-19)	not specified	2,4	none	none	none	none	Associated with tank farm waste, which was high pH.

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
IS-1	200-E-116 Pipeline to 241-C-151 and -152 Diversion Boxes	14	Develops conceptual approach to closure of ancillary equipment (pipelines, Diversion Boxes, and similar structures) based on C Tank Farm (p. ES-1):, includes limited information on the 200-E-116 Pipeline, which transported waste from the B Plant (241-B-154 Diversion Box) to the 241-C-151 and 241-C-152 Diversion Boxes in the C Tank Farm (p. 2-20).	Two SS lines marked V130 and V111 (also known as 8902) (p. 2-20)	not specified	Leak suspected - unplanned release site (p. 2-19)	radioactive mixed waste (p. 2-20) originating from B Plant	2,4	none	none	none	none	The 241-C-151 Diversion Box was determined to be the source of UPR-200-E-68 (p. 2-21). Associated with tank farm waste, which was high pH.
UW-1	216-U-1 & 216-U-2	3	For pipeline from U Plant to 216-U-1/2 Cribs: provides remote camera survey for pipe integrity; sampling of liquid within pipeline (4.2)	3.5-in. outside diameter SS; joints are butt-welded (4.2)	7 ft (4.2.2)	No	acidic and high in radionuclides (4.2)	1	Yes	none	liquid from within the pipe was collected (4.2.2); pipe was intact with liquid in low spots (5.0); last 20-30 ft went on line before the 241-U-361 Settling Tank was filled with liquid; none of the soils exterior to the pipe showed signs contamination (5.0); results to be reported in the 200-UP-2 limited field investigation summary report (4.2.2)	Surface rad survey (3.1.4.3)	none
		4	Additional information on activities reported in Ref. #3b; also reported 216-U-1/2 characterization data and operable unit risk assessment.	3.5-in. SS pipeline	not specified	not specified	not specified	1	none	none	Wipe samples of pipeline interior showed up to 30,000 cpm, but the exterior of the pipe and the surrounding soils showed no activity (3.2.3).	Waste site surface rad survey and soil sampling and subsurface gamma logging and soil sampling results discussed (3.2.1 to 3.2.5 and Tables 3-1 and 3-2)	SS may degrade at low pH and high heat.
	216-U-4A	27	Provides information on the 216-U-4A French Drain; mentions associated piping from the 216-U-4 Reverse Well (p. 9-6).	3-in.SS (p. 9-6)	~6 ft (p. 9-6)	not specified	acidic plutonium and fission product decontamination waste (p. 9-6)	1	none	none	none	Appendix B shows radionuclide inventory and hazardous chemical inventory	SS may degrade at low pH and high heat.
	216-U-8 & 216-U-12	27	Provides information on the 216-U-8 Crib; mentions associated piping from the 221-U and 224-U Buildings and the 291-U Stack (p. 9-8).	6-in.VCP in a 12-in.concrete encasement (p. 9-8)	not specified	not specified	acidic process condensate and stack drainage (p. 9-8)	1	none	none	none	Appendix B shows radionuclide inventory and hazardous chemical inventory	none
			Provides information on the 216-U-8 Crib; mentions associated pipeline from the 216-U-8 Crib feed line; waste from the 224-U Buildings, 291-U Stack, and tanks C-5 and C-7 (p. 9-9).	6-in.VCP (p. 9-9)	not specified	not specified	acidic process condensate, stack drainage, tank, and storm drain wastes (p. 9-9)	1	none	none	none	Appendix B shows radionuclide inventory and hazardous chemical inventory	none
		3	For pipeline from 222-U and 224-U Buildings to 216-U-8/-12 Cribs: provides remote camera surveys for pipe integrity (4.1); surface soil and vegetation sampling (3.2, 4.1), subsurface soil sampling (4.1), and surface rad survey (3.1.4.3).	6-in.VCP with acid-proof joints (4.1)	7-12 ft (3.1.4.3)	Leaks suspected because of joint condition (4.1.2.1)	acidic (4.1)	1	115 m of older (to 216-U-8) pipe section and 25 m of newer (to 216-U-12) pipe section (Fig. 5)	Soil samples (23) collected from 7 areas at surface, at pipe depth, and midway between along the path of older (216-U-8) pipe section (4.1.2.2, Figure 7); analysis was for rad and select chemical constituents (3.0)	Pipe relatively intact except joints of older section (5.0); sampling results summarized in App. A and App. B.	Surface rad survey (3.1.4.3) showed clear pattern where VCP was located (4.1.1)	Note: schedule 40 SS pipe routed around 2715-U Building, then changes to a 6-in.VCP as reported here (4.1).

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
UW-1	216-U-8 & 216-U-12	4	Reported additional information on pipeline activities reported in Ref. #3a; also reported 216-U-8/12 Crib characterization data and operable unit risk assessment.	6-in.VCP	not specified	Leaks suspected because of joint condition (3.4.2)	not specified	1	none	18 soil and 8 vegetation samples	Maximums generally were found near VCP (except in vegetation for Sr-90); lateral movement of contaminants was minimal (3.4.3); sample results for maximum concentrations in Tables 3-4 and 3-5; many of the older (216-U-8) joints were dislodged; the degree of dislodging varied from minor to very serious (3.4.2).	waste site sampling and borehole logging results (3.4.3 to 3.4.5 and Tables 3-4 to 3-7).	none
		7	Provides existing data for the 216-U-8 Crib, with information on the pipeline that carried waste from the 221-U and 224-U tanks and the 291-U-1 Stack (2.2.3.3) to the 216-U-8 Crib.	6-in. VCP (2.2.3.3)	not specified	Leaks suspected because of joint condition (3.3.1.3)	acidic process condensate and stack drainage (2.2.3.3)	1	none	vegetation sampling near pipeline	detected 426 pCi/g Am-241, 49,100 pCi/g Cs-137, 70.6 pCi/g Pu-239/240, and 1,380 pCi/g Sr-90 (3.3.1.3, Tables 3-2 and 3-3).	previous waste site logging results, borehole data, and soil/vegetation contaminant concentrations summarized (3.3.1.3 and Tables 3-2 to 3-5)	Operated from 1952 until crib was replaced by 216-U-12 in 1960 (2.2.3.3)
			Provides existing data for the 216-U-12 Crib, with information on the pipeline carrying waste from the U Plant [291-U-1 Stack drainage, 244-WR Vault waste, 224-U process condensate, storm drain, and tank C-7 waste, 224-B waste from tanks C-5 and C-7, (2.2.3.4)] to the 216-U-12 Crib.	6-in. VCP	17 ft at crib inlet (3.3.1.4)	not specified	corrosive (D0002) mixed waste (2.2.3.4) containing nitrate and tributyl phosphate	not specified	none	none	none	Previous waste site soil/vegetation sampling and logging results summarized (2.2.3.4, 3.3.1.4 and Tables 3-4 and 3-5)	Replaced 216-U-8 Crib in 1960, and was replaced by 216-U-17 Crib in 1988. Pipeline runs from 216-U-8 Crib feed line to 216-U-12 Crib
UW-1	216-U-8	27	Provides information on the 216-U-8 Crib; mentions associated piping between the three crib structures (p. 9-8).	6-in.schedule 40 steel (p. 9-8)	not specified	not specified	acidic process condensate and stack drainage (p. 9-8)	1	none	none	none	Appendix B shows radionuclide inventory and hazardous chemical inventory	SS may degrade at low pH and high heat.
	216-U-16	27	Provides information on the 216-U-16 Crib; mentions associated pipeline from 224-U, 221-U, and 271-U (pp.9-11 and 9-12).	from distribution box through two 8-in.PVC header pipes (p. 9-11)	not specified	not specified	steam and process condensate, chemical sewer waste, and compressor cooling water (p. 9-12)	not specified	none	none	none	Appendix B shows radionuclide inventory and hazardous chemical inventory	none
	216-U-17	27	Provides information on the 216-U-17 Crib; mentions associated pipeline from UO_3 process condensate (p. 12).	6-in.poly-ethylene	not specified	not specified	process condensate	not specified	none	none	none	Appendix B shows radionuclide inventory and hazardous chemical inventory	none
		18	Provides waste stream characterization data for UO_3 Plant condensate stream that flowed from 224-U to the 216-U-17 Crib until July 1989, when discharge was temporarily suspended (pp. v, 2-5).	not specified	not specified	not specified	neutralized process condensate	not specified	none	none	none	5 waste stream samples taken in 1990 (p. 3-1; results in Appendix A, Tables 3-2 and 3-3.	Note: moved waste stream from 216-U-12 Crib to 216-U-17 Crib in 1988 (p. 1-4)
	241-C-152 Diversion Box	1	Provides data summary from investigation of leak in the V-122 line that carried 221-B Building cesium ion-exchange process feed from the 241-C-105 Tank to the 241-C-152 Diversion Box (p. 2).	3-in. SS to 3-in. carbon steel (p. 3)	11 ft (p. 3)	Leak near the 241-C-152 Diversion Box; at joint with polyethylene gasket (p. 2)	high-level liquid waste containing Cs-137 as a major constituent (p. 2)	not specified	none	Soil samples collected from 10 wells drilled from 4 to 16 ft from pipeline leak source and to depths of 30 ft (p. 2)	radiological data used to plot three general concentration zones (Fig. 7, p. 12); radionuclides reported were Cs-137, Ce-144, Zr, Nb-95, Ru-106, and Cs-134 (p. 3); soil results summarized (p. 13).	none	none

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
Waste Management Area	241-C-151, -152, and -153 Diversion Boxes	20	Planned UPR-200-E-82 borehole sampling and near-surface characterization using direct pushes (pp. 6-14 & 6-17). Will provide geophysical data and soil samples near the 241-C-151, -152, and -153 Diversion Boxes (and an unplanned release site near the 241-C-152 Diversion Box - p. 6-7).	not specified	not specified	Past leak event (p. 6-7)	high-activity derivatives of PUREX waste (p. 6-7)	2,4	none	Samples to be collected	To be reported: data for a complete set of radiological and chemical contaminants (p. 6-14).	Samples may be collected	Purposes: to determine extent and magnitude of vertical Tc-99 migration (p. 6-13); to provide useful indication of effects of tank structures on infiltration rates (p. 6-7; to provide pipeline status, sample the pipe, or external pipe tests (pp. 6-13 to 6-14); and to provide contaminant concentration and distribution data (p. 6-18). Field reports for geophysical logging will be prepared after direct pushes are completed.
Waste Management Area	241-B-151, -152, and -153 Diversion Boxes	21	Will provide geophysical data and the potential for soil samples near the 241-B-151, -152, and -153 Diversion Boxes (unplanned release site - p. 5-4).	not specified	not specified	metal waste leaks in vicinity of 241-B-151, -152, and -153 Diversion Boxes (p. 5-5)	Metals, uranium, and possibly Tc-99 (Ref. 21, p. 4-10)	not specified	none	Samples may be collected near corners of Diversion Boxes from 10 ft. bgs to base of the tanks (p. 4-10)	To be reported: gamma logging and potential soil sampling results (p. A-25).	Samples may be collected	Purpose: to determine effectiveness of reported past clean-up and whether additional investigations are required (p. A-25). Field reports will be prepared after direct pushes are completed.
Various	Multiple	2	Provides summary of existing information on various waste sites.	not specified	not specified	not specified	not specified	not specified	none	none	none	none	none
	C Tank Farm	22, 23	Provide information about 8 borings drilled to assess soils adjacent to leak in process transfer line from 244-AR Vault to the C Tank Farm (Ref. 22, Vol 1, p. 102; Ref. 23, p. 1)	2-in.line; carbon steel and SS (Ref. 22, Vol 1, p. 104; Ref. 23, p. 2)	8 ft (Ref. 22, Vol 1, p. 104; Ref. 23, p. 2)	Line leak (Ref. 22, Vol 1, p. 102; Ref. 23, p. 1)	Process waste containing Cs-137 (Ref. 22, Vol 1, p. 102; Ref. 23, pp.1- 2)	not specified	none	Soil samples collected from 8 test wells; number of samples not specified (Ref. 22, Vol 1, p. 104; Ref. 23, p. 2)	8 test wells (Ref. 22, Vol 1, p. 103; Ref. 23, p. 1); soil contamination up to 334 µCi/g Cs-137; samples near pipeline showed contamination zone near location of a carbon steel to stainless steel joint in the pipeline (Ref. 22, Vol 1, pp.104, 106; Ref. 23, pp.2,4)	none	none
	Pipes under 221-U Building	8	Provides data for two (north and south) sections of drainline under 221-U process cells into tank 5-6 in 221-U process cell 10 (2.4.4) as part of further characterization activities identified in the Phase 1 feasibility study (2.4).	24-in. VCP under building (2.4.4)	not specified	None detected (2.4.4)	not specified	not specified	Remote video and gamma (2.4.4)	none	Two (one each from south and north sections) "opportunistic" samples of residual on robotic crawler were collected from inside the pipe (2.4.4); South section sample contained rad levels ~2 orders of magnitude greater than in the north section, where transuranic activity >100 nCi/g, and elevated levels of chromium, lead, and Aroclor 1254 (expired trademark) occurred. The north section sample contained elevated mercury and phthalates (2.4.4); for both samples ("radionuclide concentrations characteristic of the 221-U facility and processes"). Overall dose rates in pipe ~100 mrem/h (2.4.4). Complete sample data in Table 2-2.	none	none

Table A-1. Summary of Existing Characterization Data for Pipelines Systems. (10 Pages)

Process Waste Operable Unit	Disposal Sites with Assoc. Pipes	Ref. Source	Summary of Applicable Information	Pipeline Attributes					Available Types of Characterization Data				Other Results/Comments
				Pipe Material Type	Pipe Depth (bgs)	Leaks/Plugs	Waste Stream Info.	Waste Type*	Camera Surveys Inside Pipelines	Soil or Vegetation Sampling Adjacent to Pipeline	Additional Pipeline Information/Results	Related Data	
Various	Pipes under 221-U Building	10	Provides summary of existing data for a cell drainage tile line to cell 10 in 221-U.	24-in. VCP encased (within building)	not specified	not specified	not specified	not specified	none	none	none	none	none

Referenced Sources:
[1]ARH-1945, *B Plant Ion Exchange Feed Line Leak.*
[2]ARH-2155, *Radioactive Liquid Waste Disposal Facilities 200 West Area.*
[3]BHI-00033, Rev. 0, *Surface and Near-Surface Field Investigation Data Summary Report for the 200-UP-2 Operable Unit.*
[4]DOE/RL-95-13, Rev. 0, *Limited Field Investigation for the 200-UP-2 Operable Unit.*
[5]DOE/RL-2003-11, *Remedial Investigation for: the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units.*
[6]DOE/RL-99-66, Rev. 1, *U Pond/Z Ditches Cooling Water Group Operable Unit RI/FS Work Plan, Including the 20-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*
[7]DOE/RL-2000-60, Rev. 1, Re-issue, *Uranium-Rich/General Process Condensate and Process Waste Group Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan.*
[8]DOE/RI-2001-11, Rev. 0, *Final Feasibility Study for the Canyon Disposition Initiative (221-U Facility).*
[9]DOE/RL-2002-69, Draft A *Feasibility Study for the 200-CW-1 and the 200-CW-3 Operable Units and the 200 North Area Waste Sites.*
[10]HW-19140, *Uranium Recovery Technical Recovery Manual.*
[11]RHO-LD-114, *Existing Data On the 216-Z Liquid Waste Sites.*
[12]RHO-ST-21, *Report on Plutonium Mining Activities at 216-Z-9 Enclosed Trench.*
[13]RHO-ST-44, *216-Z-12 Transuranic Crib Characterization: Operational History and Distribution of Plutonium and Americium.*
[14]RPP-20604, *Ancillary Equipment Disposition Study.*
[15]RPP-20605, *Cross-Site Transfer System Disposition Study.*
[16]WHC-EP-0342, Addendum 12, *PUREX Plant Process Condensate Stream-Specific Report.*
[17]WHC-EP-0342, Addendum 14, *PUREX Plant Ammonia Scrubber Condensate Stream-Specific Report.*
[18]WHC-EP-0342, Addendum 19, *UO_3 Plant Process Condensate Stream-Specific Report.*
[19]WHC-SD-NR-ER-103, *Final Report for the Remote CCTV Survey of Abandoned Process Effluent Drain Lines 840 and 840D in Support of the 200 West Area Carbon Tetrachloride ERA.*
[20]RPP-16608, Rev. 1, *Site-Specific Single Shell Tank Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan Addendum for Waste Management Areas C, A-AX, and U.*
[21]RPP-6072, Rev. 1, *Site-Specific SST Phase 1 RFI/CMS Work Plan Addendum for WMA B-BX-BY.*
[22,23]ARH-1972, included in RHO-CD-673 as pp.103-106, *Handbook 200 Areas Waste Site (RHO-CD-673); PSS Line Leak (Line No. 812).*
[24]DOE/RL-92-05, *B Plant Source Aggregate Area Management Study Report.*
[25]DOE/RL-91-60, *S Plant Source Aggregate Area Management Study Report.*
[26]DOE/RL-91-61, *T Plant Source Aggregate Area Management Study Report.*
[27]BHI-00174, *U Plant Aggregate Area Management Study Technical Baseline Report.*
[28]80322-88-090, *Surface Contamination Investigation Report, Cross-Country Waste Transfer Line,* letter report from R. E. Wheeler to J. C. Bergam, Westinghouse Hanford Company, Richland, Washington.

*Waste Stream Type No:
1= Very Acidic.
2= High Salts/Very Basic.
3= Chelates/High Salt.
4= Low Salts/Near Neutral.

PUREX = Plutonium-Uranium Extraction (Plant or process).
RECUPLEX = Recovery of Uranium and Plutonium by Extraction (Plant or process).

SS = stainless steel.
VCP = vitrified clay pipeline.

WIDS = *Waste Information Data System* database.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
1	200-W-7	200-W-7, 246-L, 241-S-TK-1, 243S-TK-1, 243-S-TK1, 200W Personnel Decontamination Facility catch tank, IMUST, Inactive Miscellaneous Underground Storage Tank	The site is located northwest of the 242-S Evaporator and just north of the MO-326 trailer.	1978 to 1988	Associated with the MO-0326 trailer. It was the personnel decontamination facility for the 200 West Tank Farms.	The underground tank is inside a chained area that measures approximately 3 by 3 m (9 by 9 ft), with three risers extending to the surface. The tank is posted with IMUST signs and radiological postings.	Catch Tank	none	3 x 3 m (10 x 10 ft)	Waste contents would contain low levels of radionuclides.	none

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
2	240-S-302	240-S-302, 240-S-302 Catch Tank, IMUST, Inactive Miscellaneous Underground Storage Tank	This unit is located north of the 202-S Building and east of the 240-S-151 Diversion Box.	1950 to 1987	Associated with the 240-S-151 Diversion Box.	This unit is a horizontal, cylindrical, steel tank. The 240-S-302 Catch Tank is buried underground to provide shielding from radiation. The tank is surrounded with posts and chain and is posted with radiological and IMUST signs.	Catch Tank	none	not available	Tank received leakage, spillage, line flushes, and drainage associated with waste transfers. In 1985, the tank was confirmed to be a leaker. Approximately 600 gal of rainwater were released between June 1985 and January 1986.	none
3	241-A-302A	241-A-302A, 241-A-302-A Catch Tank	The catch tank is located south of the east end of the 202-A Building and west of the 241-A-151 Diversion Box. It is located inside the PUREX security fence.	1956 to ?	Associated with the 241-A-151 Diversion Box.	The unit is an underground, cylindrical vessel made of carbon steel. It sits inside a pump pit with a riser extending to the surface. It is surrounded with posts and chain and is marked with radiological signs.	Catch Tank	none	not available	1996 waste estimated as 6418 L (1698 gal).	none
4	241-B-302B	241-B-302B, 241-B-302-B Catch Tank, 241-B-302, IMUST, Inactive Miscellaneous Underground Storage Tank	This catch tank is located north of the 241-B-154 Diversion Box, adjacent to the corner of 7th Street and Baltimore Avenue.	1945 to 1985	Associated with B Tank Farm and 241-B-154 Diversion Box.	This unit is an underground, horizontal carbon steel tank. The catch tank and the 241-B-154 Diversion Box are surrounded with post and chain. The surface of the area inside the chain has been covered with gravel and sprayed with gray weatherizing material. The site is marked with radiological and IMUST signs.	Catch Tank	none	not available	1985 estimated volume of liquid as 16,027 L (4249 gal) and sludge as 2608 L (690 gal).	none
5	241-BX-302B	241-BX-302B, 241-BX-302-B Catch Tank, IMUST, Inactive Miscellaneous Underground Storage Tank	The 241-B-302B Catch Tank is located on the south side of the 221-B Building (near section 12), and northwest of 241-BX-154 Diversion Box.	1948 to 1985	Associated with 241-BX-154 Diversion Box and BX Tank Farm.	The buried tank is covered with gravel. It is surrounded with post and chain. The tank is marked with radiological and IMUST signs.	Catch Tank	none	not available	Estimated residual volume of supernate as 355 L (94 gal) and sludge as 3591 L (950 gal).	none
6	241-BX-302C	241-BX-302C, 241-BX-302-C Catch Tank, IMUST, Inactive Miscellaneous Underground Storage Tank	The 241-BX-302C Catch Tank is located southeast of 241-BX -155 Diversion Box, between Atlanta Avenue and Baltimore Avenue.	1948 to 1985	Associated with the 241-BX-155 Diversion Box and BX Tank Farm.	This catch tank is a horizontal cylinder of direct buried carbon steel. It is inside a recently graveled URM area, related to the 241-BX-155 Diversion Box surface stabilization. The tank was not covered with extra gravel and is separately posted as a CA. The tank is marked with radiological and IMUST signs.	Catch Tank	none	not available	1984 estimated volume of sludge as 2400 L (635 gal) and supernate as 862 L (228 gal).	none
7	241-ER-311	241-ER-311, 241-ER-311 Catch Tank, 241-ER-311A Replacement Tank	The tank is located south of the B Plant, and west of Atlanta Avenue, inside the 241-ER-151 Diversion Box fence.	1954 to 1991	Associated with the 241-ER-311A Catch Tank, 241-ER-151, 241-ER-152, and 241-ER-153 Diversion Boxes, automatic liquid level sensors, leak detection, and a submersible pump.	The underground tank is located inside the 241-ER-151 Diversion Box locked chain link fence. The fence is posted as a CA and a URM area, and is labeled with IMUST signs. The placement of these structures within the fence is that the 241-ER-311 Catch Tank is the furthest south, nearest the chain link fence. The 241-ER-311A Catch Tank is located adjacent to the north side of the 241-ER-311 tank (in the middle of the three structures). The 241-ER-151 Diversion Box is north of the 241-ER-311A Catch Tank.	Catch Tank	UPR-200-E-84	not available	not available	none
8	241-ER-311A	241-ER-311A, 241-ER-311A Catch Tank, old 241-ER-311, original 241-ER-311 Catch Tank, IMUST, Inactive Miscellaneous Underground Storage Tank	This unit is below grade. The tank is located southwest of the B Plant. It is south of 7th Street and west of Atlanta Avenue.	1950 to 1954	Associated with the 241-ER-151 Diversion Box.	It is located within a chain link fence that is posted as a CA and a URM area, and is labeled with IMUST signs. The 241-ER-151 Diversion Box, the 241-ER-311 Catch Tank, and the 241-ER-311A Catch Tank all are located inside this chain link fence. The placement of these structures within the fence is that the 241-ER-311 Catch Tank is the furthest south, nearest the chain link fence. The 241-ER-311A Catch Tank is located adjacent to the north side of the 241-ER-311 Catch Tank (in the middle of the three structures). The 241-ER-151 Diversion Box is north of the 241-ER-311A Catch Tank.	Catch Tank	none	not available	not available	none

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
9	241-EW-151	241-EW-151, 241-EW-151 Vent Station Catch Tank, 241-EW-151 Vent Station, Vent Station, 200 Area East-West Vent Station	The site is located south of Route 3, approximately halfway between the 200 East and West Areas. It is south of the 609-A Fire Station.	1955 to ?	This site is part of the cross-site waste transfer system and is associated with Diversion Boxes 241-UX-154 (200 West) and 241-ER-151 (200 East). The vent station is associated with the cross-site transfer line that runs between Diversion Boxes 241-UX-154 (200 West) and 241-ER-151 (200 East).	The vent station is enclosed in a locked, chain link fence. It consists of an underground concrete structure containing a stainless steel tank in a vault with a jumper pit above the tank. The tank has two vent risers that extend above grade and a riser for the unit's leak detection system. At the bottom of the stairwell access is a floor drain that connects to a nearby french drain. Several hazard and radiological warning signs are posted on the fence. Also, two areas outside the fence, adjacent to the northeast side of the vent station, are posted with URM area signs.	Catch Tank	UPR-600-20	not available	not available	none
10	241-TX-302B	241-TX-302B, 241-TX-302-B Catch Tank, IMUST, Inactive Miscellaneous Underground Storage Tank	This tank is located east of the TX Tank Farm, northeast of the 241-TX-155 Diversion Box.	1949 to 1982	Associated with the 241--TX-155 Diversion Box, and 241-TX-302BR Catch Tank.	This unit is an underground cylindrical tank made of steel. The ground surface around the tank has been covered with gravel. The tank is surround with light posts and chain and is posted with CA and IMUST signs.	Catch Tank	UPR-200-W-131	not available	1984 estimated volume waste as 4987 L (1320 gal).	Tank sampled in 1984; reported dose rate of 24 mrad/h and pH 9.95.
11	241-TX-302BR	241-TX-302BR, 241-TX-302BR Catch Tank, 241-TXR-302BR, IMUST, Inactive Miscellaneous Underground Storage Tank	The 241-TX-302BR Catch Tank is located east of the 241-TX-155 Diversion Box. It is located east of Camden Avenue and south of 23rd Street.	1950 to 1954	Associated with UPR-200-W-131, 241-TX-155 Diversion Box, 241-TX-302B Catch Tank, and 216-T-20 Acid Pit.	This unit is an underground horizontal, cylindrical tank made of steel. The ground surface around the tank has been covered with gravel. The tank is surrounded with posts and chain and is labeled with IMUST signs.	Catch Tank	none	not available	not available	none
12	241-TX-302C	241-TX-302C, 241-TX-302-C Catch Tank	The 241-TX-302 Catch Tank is located southeast of the center of the 221-T Building.	1949 to ?	Associated with the 241-TX-154 Diversion Box.	This unit is an underground horizontal, cylindrical tank made of carbon steel. The tank area has been sprayed with shotcrete to control surface contamination.	Catch Tank	UPR-200-W-38	not available	not available	none
13	240-S-151	240-S-151, 240-S-151 Diversion Box	The 240-S-151 Diversion Box is located north of the 202-S Canyon Building.	1950 to 1987	Associated with the 240-S-302 Catch Tank, UPR-200-W-82, and S Tank Farm	This unit is constructed of reinforced concrete and is rectangular in shape. The 240-S-151 Diversion Box has been weather covered.	Diversion Box	UPR-200-W-82	not available	not available	none
14	240-S-152	240-S-152, 240-S-152 Diversion Box	The 240-S-152 Diversion Box is located north of the 202-S Canyon Building.	1977 to 1980	Associated with 240-S-302 Catch Tank and S Tank Farm.	This unit is constructed of reinforced concrete and is rectangular in shape. The 240-S-152 Diversion Box has been weather covered.	Diversion Box	none	not available	not available	none
15	241-A-151	241-A-151, 241-A-151 Diversion Box	The diversion box is located south of the east end of the 202-A Building.	1956 to ?	Associated with 241-A-302-A Catch Tank, A and AX Tank Farms.	The site is a reinforced concrete structure with cover blocks. Most of the structure is below grade. It is marked and radiologically posted.	Diversion Box	UPR-200-E-25, UPR-200-E-26, UPR-200-E-31, UPR-200-E-42, UPR-200-E-65	not available	Multiple UPRs. Highly concentrated process wastes have contaminated the inside of the diversion box.	none
16	241-B-154	241-B-154, 241-B-154 Diversion Box	The unit is located east of 221-B, at the intersection of Baltimore Avenue and 7th Street.	1945 to 1984	Associated with B Plant, 241-B-302 Catch Tank, 241-B-151, 241-B-152, and 200-E-116.	The site is a diversion box that interconnects the 241-B-151 and 241-B-152 Diversion Boxes with the 221-B Building. The unit is a rectangular, reinforced concrete structure. It was sprayed with gray, weatherizing foam. Later, a layer of shotcrete was placed over the diversion box, extending beyond the structure to include the surrounding ground surface.	Diversion Box	UPR-200-E-45, UPR-200-E-77	not available	Diversion box may contain about 23 kg (50 lb) of lead shielding.	none
17	241-BX-154	241-BX-154, 241-BX-154 Diversion Box	This Diversion Box is located south of the 221-B Building and east of the 241-BX-302B Catch Tank.	1948 to 1985	Associated with the 241-BX-302-B Catch Tank and the BX Tank Farm. This unit interconnects the 241-B-252 and 241-BX-155 Diversion Boxes and the 221-B Building.	This diversion box is a reinforced concrete structure.	Diversion Box	UPR-200-E-77	not available	not available	none
18	241-BX-155	241-BX-155, 241-BX-155 Diversion Box	This Diversion Box is located northeast of B Plant on the south side of Atlanta Avenue.	1948 to 1984	Associated with the 241-BX-302-C Catch Tank and the BX Tank Farm.	This diversion box is a reinforced concrete structure. The diversion box has been isolated and covered with water proof foam sealant. The area around the diversion box has been surface stabilized with gravel and posted with URM area signs, except for the surface area above the 241-B-302-C Catch Tank. This area does not have the additional layer of gravel and remains posted as a CA.	Diversion Box	UPR-200-E-78	not available	not available	none

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
19	241-C-154	241-C-154, 241-C-154 Diversion Box	The Diversion Box is located south of 7th Street, southeast of the (demolished) 201-C Process Building and northeast of the 216-C-1 Crib.	1946 to 1985	Associated with the 201-C C-Cell, the B Plant Promethium Transfer Line (line V743), and 200-E-41 stabilized area.	The diversion box has been covered with clean backfill material (ash) and is no longer visible. It is located within the larger Hot Semiworks surface stabilized area (200-E-41).	Diversion Box	none	not available	not available	none
20	241-ER-151	241-ER-151, 241-ER-151 Diversion Box	The site is located southwest of the B Plant and near the corner of 7th Street and Atlanta Avenue.	1945 to ?	Associated with the 241-ER-311 Catch Tank, the Cross Site Transfer Line, 241-EW-151 Vent Station, the 244-BX Double Contained Receiver Tank, and the 241-ER-152, 241-ER-153, and 241-UX-154 Diversion Boxes and the 241-ER-311 Catch Tank.	The diversion box is located inside a locked chain link fence. The fence is posted with "Caution - contact Radiological Control and Tank Farm Shift Office prior to entry" signs. The diversion box is surrounded with a metal safety barricade.	Diversion Box	UPR-200-E-84, UPR-600-20	not available	Diversion box may contain about 23 kg (50 lb) of lead shielding.	September 1998 rad surveys detected up to 10,000 cpm on contaminated specks and 25,000 cpm on ant hill.
21	241-ER-152	241-ER-152, 241-ER-152 Diversion Box	This 241-ER-152 Diversion Box is southeast of the 224-B Building, and east of 241-ER-151 Diversion Box, near the corner of Atlanta Ave. and 7th Street.	1945 to ?	Associated with the 241-ER-151 and 241-ER-153 Diversion Boxes, the 241-ER-311 Catch Tank, and transfer lines. It is also associated with the stabilized contamination know as 200-E-29.	Most of the reinforced concrete diversion box structure is underground. The floor and lower portions of the walls are lined with stainless steel. Cover blocks with lifting hooks are visible from the surface. The 241-ER-152 Diversion Box is surrounded with radiation rope and CA signs.	Diversion Box	none	~540 m^2 (6000 ft^2); in 1996, contamination spread over an area measuring approximately 0.5 ha (1.2 ac).	not available	none
22	241-TX-152	241-TX-152, 241-TX-152 Diversion Box	This unit is located east of the TX Tank Farm. It is east of Camden Avenue and south of 23rd Street. It is north of the 200 West Area Powerhouse pond.	1949 to ?	Associated with the T Plant, SY Tank Farm, UPR-200-W-113, and the 241-TX-154 Diversion Box.	The diversion box is a rectangular reinforced concrete structure. Most of the structure is below ground. A few inches of the structure that extends above ground is covered with a gray weather coating. It is surrounded with light posts and chain and is posted with various radiological postings.	Diversion Box	none	not available	Diversion box may contain about 23 kg (50 lb) of lead shielding.	none
23	241-TX-154	241-TX-154, 241-TX-154 Diversion Box	This unit is located on the east side of the 221-T Building.	1949 to ?	Associated with T Plant operations, 241-TX-152 Diversion Box, 241-TX-302C Catch Tank, and SY Tank Farm.	The diversion box is a rectangular reinforced concrete structure. Most of the structure is below ground. The diversion box is surrounded with post and chain. It is labeled and radiologically posted. The adjacent area has been covered with shotcrete.	Diversion Box	UPR-200-W-21, UPR-200-W-38, UPR-200-W-40, UPR-200-W-160	not available	Diversion box may contain about 23 kg (50 lb) of lead shielding.	none
24	241-TX-155	241-TX-155, 241-TX-155 Diversion Box	This unit is located east of the TX Tank Farm, south of 23rd Street and north of the 200 West Area Powerhouse pond.	1949 to 1980	Associated with the 241-TX-302B and 241-TX-302BR Catch Tanks, and the T, TX, and TY Tank Farms.	The diversion box is a rectangular reinforced concrete structure. Most of the structure is below ground. A few inches of the structure that extends above ground is covered with a gray weather coating. It is surrounded with light posts and chain and CA signs.	Diversion Box	UPR-200-W-5, UPR-200-W-28, UPR-200-W-76, UPR-200-W-113, UPR-200-W-131, UPR-200-W-160	9 x 30.5 m (in 1954)	Multiple releases documented, including contaminated nitric acid solution in 1952. Diversion box may contain about 23 kg (50 lb) of lead shielding.	none
25	241-U-151	241-U-151, 241-U-151 Diversion Box	The 241-U-151 Diversion Box is located northeast of the intersection of Camden Avenue and 16th Street, east of the U Tank Farm.	1946 to ?	Associated with the 241-U-301 Catch Tank and the 244-S and 244-TX Double Contained Receiver Tanks. The unit also is associated with the 241-U-152 and 241-TX-152 Diversion Boxes.	The diversion box is marked and radiologically posted. This unit is constructed of reinforced concrete with multiple encased liquid waste transfer lines. The diversion box structure is mostly below ground. It has three layers of cover blocks.	Diversion Box	UPR-200-W-6	not available	Diversion box may contain about 23 kg (50 lb) of lead shielding.	none
26	241-U-152	241-U-152, 241-U-152 Diversion Box	The 241-U-152 Diversion Box is located northeast of the intersection at Camden Avenue and 16th Street, east of the U Tank Farm.	1946 to ?	The 241-U-152 Diversion Box is associated with the 241-U-301 Catch Tank, and 241-U-153 Diversion Box.	The diversion box is marked and radiologically posted. The unit is constructed of reinforced concrete with multiple encased liquid waste transfer lines. The diversion box structure is mostly below ground. It has three layers of cover blocks.	Diversion Box	UPR-200-W-6	not available	Diversion box may contain about 23 kg (50 lb) of lead shielding.	none
27	200-W-125	200-W-125, 216-Z-1 Ditch replacement pipeline	The pipeline extends east from the 231-Z Building and turns south to connect with the head end of the 216-Z-11 Ditch.	not specified	Associated with 216-Z-1 Ditch, 216-Z-11 Ditch, and the 231-Z building	The site is an underground buried pipeline. The pipeline is a 0.46 m (18 in.) diameter VCP.	Radioactive Process Sewer	none	not available	not available	none

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
28	200-W-16	200-W-16, 292-T underground tanks, IMUST, Inactive Miscellaneous Underground Storage Tank, 292-TK-1, 292-TK-2	The underground tanks are near the southeast corner of the 292-T Building addition. The 292-T Building is south of the 291-T Stack and north of the 222-T Building.	1944 to 1970	Associated with 291-T, 221-T, and the 292-T facility (200-W-40).	Two metal riser pipes extend about 0.5 m (1.5 ft) above grade near the southeast corner of the 292-T building addition. Both are capped and one appears to have a pressure relief vent. These pipes extend from two buried tanks (292-TK-1 and 2). A chain link fence encloses the area where the tanks are located. The fence is posted with Access Restricted signs. The site is within a chained area posted "Contamination Area."	Storage Tank	none	not available	Unknown quantity of material placed into tanks.	Rad survey done in 1995 revealed a 2 mrem/h dose rate above the tanks.
29	200-E-111-PL	200-E-111-PL, encased pipeline from 241-ER-151 Diversion Box to C Tank Farm and 244-AR Vault, 3-38 encasement, V108/V837/8618/8653/8901 PAS	The encased pipeline runs eastward from the 241-ER-151 Diversion Box, south of 7th Street, and branches off in two directions (forming a "Y") at a point southeast of the 216-C-10 Crib. From the "Y," it branches to the C Tank Farm and the 244-AR Vault.	1952	Waste transfer encasement connected to the 241-ER-151 Diversion Box, 241-ER-152 Diversion Box, 241-CR-151, C Tank Farm, and the 244-AR Vault.	The site is an underground piping encasement that contains three 7.5-cm (3 in.)-diameter, stainless-steel waste transfer pipelines, numbered "V108," "8618," and "8653," which run from the 241-ER-151 Diversion Box through a "Y" that branches to the C Tank Farm and the 244-AR Vault. The section from the "Y" junction to the 244-AR Vault contains two 7.5-cm (3-in.) pipelines numbered "809" and "818." There is a posted CA on top of the line at the "Y" junction where the line branches to the C Tank Farm and the 244-AR Vault. The entire length of the pipeline is marked with steel fence posts and posted as a URM area. The ground surface above the pipeline is bare in spots; other sections are vegetated with crested wheatgrass, tumbleweeds, and native grass species.	Tank Farm Process Piping	UPR-200-E-86	not available	not available	May 2000 rad survey found growing tumbleweeds at swab riser; contamination levels measured up to 2000 dpm beta/gamma.
30	200-E-116-PL	200-E-116-PL, pipelines from 241-B-154 Diversion Box to 241-C-151 and 241-C-152 Diversion Boxes, direct buried pipeline, V111/V210/V130	The site is located north of and runs parallel to 7th Street, between B Plant and the C Tank Farm in 200 East Area.	not specified	B Plant, 241-B-154 Diversion Box, 241-C-151 Diversion Box, 241-C-152 Diversion Box, and C Tank Farm.	The pipeline is posted as "Underground Radioactive Pipeline," which extends from the 241-B-154 Diversion Box to the 241-C-151 and 241-C-152 Diversion Boxes. Vegetation over the pipeline has been crushed by vehicle traffic. An area located just north of the 241-B-154 Diversion Box was posted as a High CA in September 2000, but was covered with a biobarrier and gravel in February 2001. It is now a rectangular posted URM area over a portion of the pipeline. Another area of contamination was found on this pipeline in June 2001. This area was covered with gravel and posted as a URM in August 2001.	Tank Farm Process Piping	UPR-200-E-82	not available	radioactive mixed waste	In September 2000, rad survey revealed contamination levels to 50,000 cpm. In June 2001, rad survey found contamination levels in vegetation adjacent to the area with up to 50,000 cpm.
31	200-W-78	200-W-78, pipeline between TX/TY and T Tank Farms, encased pipeline	The underground line is located in 200 West Area between the T and TX/TY Tank Farms, on the west side of Camden Avenue.	1944	Associated with T and TX Tank Farms. UPR-200-W-167 also was located in the vicinity of this pipeline.	The site is an encased, underground pipeline that runs between the 241-TXR-151 Diversion Box in the TX Tank Farm and the 241-TR-153 Diversion Box in the T Tank Farm. Outside the tank farm fence, the line is marked with "Radioactive Pipeline" signs. There are several stabilized, individually radiologically posted areas on top of (or adjacent to) this pipeline, near the east side of the TY Tank Farm perimeter fence.	Tank Farm Process Piping	UPR-200-W-167	3 m x 14 m (10 ft x 45 ft)	not available	Evidence of contaminated biological intrusion above the line. Difficult to determine which line is source of the contamination. April 2001 rad survey detected soil contamination up to 4000 cpm.
32	200-W-97	200-W-97, encased pipeline from 240-S-151 Diversion Box to 241-S-151 Diversion Box	The pipeline extends northwest from the REDOX facility to the S/SX Tank Farms.	not specified	Associated with 202-S, 203-S, 204-S, and 205-S and the 241-S-151 Diversion Box.	The site is an underground concrete-encased pipeline. The surface is marked with Underground Radioactive Material - Pipeline signs. Yellow swab risers are located along the pipeline. One swab riser, near the 204-S Facility, has been surrounded with posts and chain and is posted with Soil Contamination Area signs.	Tank Farm Process Piping	none	2.4 x 2.4 m (8 x 8 ft)	Soil contamination area located on the underground pipeline.	October 2001: rad survey detected up to 20,000 cpm on tumbleweed fragments and soil.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
33	200-W-98	200-W-98, encased pipeline from 240-S-151 to 241-U-153 Diversion Box, V458,V459,V460	The pipeline is located south of 16th Street, extending in a southeast direction from the 241-U-153 Diversion Box to 204-S and the REDOX Facility.	not specified	Associated with the 204-S Facility and the 241-U-153 Diversion Box.	The site is a cement-encased underground pipeline. The pipeline is marked with Underground Radioactive Material - Pipeline signs.	Tank Farm Process Piping	none	not available	not available	none
34	200-W-99	200-W-99, encased pipeline from 241-U-151 to 241-S-151 Diversion Boxes	The pipeline is located south of 16th Street, extending from the 241-U-151 Diversion Box to the 241-S-151 Diversion Box.	not specified		The site is a cement-encased underground pipeline. The pipeline is marked with Underground Radioactive Material - Pipeline signs.	Tank Farm Process Piping	none	not available	not available	none
35	200-W-100	200-W-100, Encased Pipeline from 241-UX-154 to 241-SX-152 Diversion Box, lines 4700, 4701, 4853, V762, V503 and V505	The pipeline begins on the east side of the 221-U building and extends in a southwest direction to terminate at the 241-SX-152 Diversion Box, located on the east side of the S/SX Tank Farms.	not specified		The site is a cement-encased underground pipeline. The pipeline is marked with Underground Radioactive Material - Pipeline signs.	Tank Farm Process Piping	none	not available	not available	In 1998, ground-penetrating radar scans in the area revealed 44 linear anomalies.
36	200-W-105	200-W-105, encased transfer line between 241-UX-154 Diversion Box and TX Tank Farm	The pipeline begins on the east side of the 221-U Building and extends in a northwest direction to terminate at the 241-TX-155 Diversion Box. The line continues through the Diversion Box to the TX Tank Farm.	1946	The encasement includes tank farm lines V-375, V-382, 4859/4703.	The site is a cement-encased underground pipeline. The pipeline is marked with Underground Radioactive Material - Pipeline signs.	Tank Farm Process Piping	none	not available	not available	In 1998, ground-penetrating radar scans in the area revealed 44 linear anomalies.
37	UPR-200-E-1	UPR-200-E-1, waste line failure on south side of 221-B	The release occurred on the south side of the 221-B Building.	The release occurred in September 1946	B Plant	The UPR is not separately marked or posted.	Unplanned Release	UPR-200-E-80	not available	The original line break was waste from the metal waste line.	In 1946, area was covered to reduce surface readings to 2 mrad/h.
38	UPR-200-E-3	UPR-200-E-3, line leak from 221-B to 241-BX-154, UN-200-E-3	The release occurred on the south side of 221-B, between the 221-B Building and 241-BX-154.	1951 The exact date of the occurrence is unknown	B Plant	The release is not separately marked or posted.	Unplanned Release	none	not available	The release consisted of B Plant first-cycle waste.	Excavation efforts abandoned when readings of 120 rad/h found with 18 in. soil remaining over pipeline.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
39	UPR-200-E-42	UPR-200-E-42, 241-AX-151 Release, UN-200-E-42	The 241-AX-151 Diversion Box is located near the corner of 4th Street and Buffalo Ave., adjacent to the 204-AR Unloading Station. The UPR site included a dirt bank east of the 241-AX-151 Diversion Box and weeds east of the established parking lot.	1972 to ?	Associated with 241-AX-151 Diversion Box and 244-AR Vault.	A WIDS sign has been placed near the diversion box structure to document the release.	Unplanned Release	none	not available	not available	In 1972, contamination of up to 300 mrad/h with spots to 20 rad/h was found. The blacktop east of the diversion box was contaminated up to 3,000 cpm. The dirt bank had contamination up to 2,000 cpm and weeds contaminated 300 to 800 cpm.
40	UPR-200-E-44	UPR-200-E-44, UN-200-E-44, B Plant Condensate Steam Waste Line Leak South of 221-B	The UPR occurred south of 221-B, near the R-17 change house, north of 7th Street. The change house no longer exists.	The release occurred in August 1972	Associated with B Plant.	The release site is not separately marked or posted. There is no visual evidence of the area that caved in.	Unplanned Release	UPR-200-E-103	0.30 m (1.00 ft) in diameter	not available	Soil removed from excavation was contaminated up to 20,000 cpm. Dose rate on pipe was up to 20 mrad/h.
41	UPR-200-E-45	UPR-200-E-45, UN-200-E-45, contamination spread from the 241-B-154 Diversion Box	The 241-B-154 Diversion Box is located at the corner of 7th Street and Baltimore Ave. The release involved loose contamination spreading in a southeasterly direction from the 241-B-154 Diversion Box.	1974	This release is related to the 241-B-154 Diversion Box.	A large area on the northeast corner of 7th Street and Baltimore Avenue is surrounded with post and chain and is marked as a URM area. The URM surrounds the 241-B-154 Diversion Box, which has been covered with a coating of gray grout. The original UPR is not separately marked or posted.	Unplanned Release	UPR-200-E-77	Approximately 91.5 x 30.5 m (300 x 100 ft)	Contaminated particles (specks) spread from inside diversion box.	Ground surface contamination up to 50,000 cpm and up to 30,000 cpm on blacktop.
42	UPR-200-E-77	UPR-200-E-77, UN-216-E-5, 241-B-154 Diversion Box Ground Contamination, UN-200-E-77	This site is located east of 221-B Building, at the northeast corner of Baltimore Avenue and 7th Street. It surrounds the 241-B-154 Diversion Box.	1946 to ?	Site associated with the 241-B-154 Diversion Box.	A large graveled area on the northeast corner of 7th Street and Baltimore Avenue is surrounded with post and chain and is marked as a URM area. The URM surrounds the 241-B-154 Diversion Box, which has been covered with a coating of gray grout. The area appears to have been posted in stages. A large posted oval area (URM) extends north and east from the diversion box. Another posted area (URM) extends west to Baltimore Ave. and turns northward. In January 2000, a separate CA was posted around a power pole (adjacent to a manhole) within the larger URM. In 2002, the posting around the power pole was removed and a Fixed Contamination Area sign was attached to the pole.	Unplanned Release	none	125 x120 m (410 x 394 ft)	Original release involved metal waste solution from 221-B Building with about 1 Ci fission products.	1975 rad survey found surface contamination up to 80,000 cpm.
43	UPR-200-E-78	UPR-200-E-78, UN-216-E-6, 241-BX-155 Diversion Box ground contamination, UN-200-E-78	This site is located in the area around the 241-BX-155 Diversion Box, south of the BX Tank Farm, northeast of B Plant between Atlanta and Baltimore Avenues.	1955 to ?		The diversion box has been isolated and covered with gray grout. The area around the diversion box and the surface area above the 241-B-302-C Catch Tank have been surface stabilized with gravel and posted with URM area signs.	Unplanned Release	none	18 m^2 (200 ft^2) area	Contaminated ground. Release involved salt-containing waste from B Plant with about 10 Ci of fission products.	At the time of the release, the maximum dose rate was 22.6 rad/h.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
44	UPR-200-E-80	UPR-200-E-80, UN-216-E-8, 221-B R-3 Line Break, R-3 Radiation Zone, UN-200-E-80	The release occurred in an underground pipeline, located on the south side of the 221-B Canyon Building, near the R-3 stairwell. The leak resulted in a contaminated area measuring 30 m (100 ft) wide by 152 m (500 ft) in length, along the south side of the 221-B building.	The release occurred in June 1946	Associated with an underground metal waste line from the 221-B Canyon Building.	The UPR is not separately marked or posted.	Unplanned Release	UPR-200-E-1	30 m (100 ft) wide by 152 m (500 ft) in length	Release of about 10 Ci of fission products from metal waste pipeline.	In 1946, the dose rate at ground surface was 400 rad/h. After covering, the dose rate was reduced to 100 mrad/h.
45	UPR-200-E-84	UPR-200-E-84, 241-ER-151 Catch Tank Leak, UN-200-E-84, UN-216-E-12	The release occurred adjacent to the 241-ER-151 Diversion Box, southwest of the 221-B Building.	1953	Associated with 241-ER-311 Catch Tank and 241-ER-151 Diversion Box.	The 241-ER-151 Diversion Box and the 241-ER-311 Catch Tank are located inside a chain link fence that is radiologically posted. A WIDS sign has been placed at the approximate location of the release.	Unplanned Release	none	not available	Contaminated acid with about 10 Ci of fission products.	In 1975, surface contamination was up to 90,000 cpm.
46	UPR-200-E-85	UPR-200-E-85, Line Leak at 221-B Stairwell R-13, UN-216-E-13, UPR-200-E-41, UN-200-E-85, UN-200-E-41	UPR-200-E-85 occurred south of the center of the 221-B Building, near the R-13 utility pit.	The release occurred in July 1972	Associated with the (unencased transfer line from the) 18-1 Tank in the 221-B Building, the 241-BX-154 Diversion Box, and the R-13 Utility Pit. This occurrence also was given the number UPR-200-E-41.	The site was stabilized in 1984 and posted with URM area signs. The release site is not labeled. The R-13 Utility Pit was covered with a steel lid.	Unplanned Release	none	15.24 x 15.24 m (50 x 50 ft)	The waste line contained ion exchange waste from tank 18-1, located inside the B Plant canyon. Soil samples collected in 1972 identified the release as predominantly Cs-137. Approximately 30 Ci of cesium were released, but half of the release was removed with the soil that was excavated to expose the line leak.	15 rad/h, 2 in. from the source.
47	UPR-200-E-87	UPR-200-E-87, UN-216-E-15, 224-B South Side Plutonium Ground Contamination, UN-200-E-87, 216-E-15	The UPR-200-E-87 site is located on the south side of the 224-B Building in the 200 East Area.	1945 to 1953; no confirmed release occurred	Associated with the underground pipelines at the 224-B Building.	Some areas on the south side of 224-B are posted with URM area signs. The release site is not specifically marked.	Unplanned Release	UPR-200-W-102	not available	About 75 g (3 oz) Pu-239 may have leaked into the soil.	1975 rad survey reported no detectable contamination.
48	UPR-200-E-96	UPR-200-E-96, Ground Contamination SE of PUREX, UN-216-E-24, UN-200-E-96	The release site includes contaminated areas on the south and east sides of PUREX.	N/A	Associated with 200-E-103, 200-E-107, the 291-A Stack, and the 241-A-151 Diversion Box.	The site was described in 1980 as an area measuring approximately 1.0 ha (2.5 acres) located adjacent to the east and south sides of 202-A (PUREX). These areas are now covered with gravel and posted as URM areas.	Unplanned Release	none	Approximately 1 ha (2.5 ac)	Contamination consisted of low-level particles.	none
49	UPR-200-W-2	UPR-200-W-2, UN-200-W-2, Underground Waste Line Leak	The cave-in occurred on the southeast side of the 221-T Facility, near stairwell R-19.	June 1947	Associated with 221-T.	The area around stairwell R-19 at the 221-T facility currently is paved with asphalt. A long, narrow URM area is posted around the R-19 area.	Unplanned Release	UPR-200-W-98	not available	Mixed process effluent	none
50	UPR-200-W-5	UPR-200-W-5, overflow at 241-TX-155, UN-200-W-5	The site consists of the 241-TX-155 Diversion Box and the adjacent hillside to the west. The diversion box is located east of Camden Avenue, east of the TX Tank Farm.	1950	Associated with the 241-TX-155 Diversion Box.	In 2000 and 2001 multiple areas of soil and vegetation contamination were identified, and all were posted. For consolidation purposes, all of the new CAs were recorded and mapped as UPR-200-W-113. A WIDS sign has been placed at the approximate location of the release.	Unplanned Release	UPR-200-W-28, UPR-200-W-113, UPR-200-W-131	not available	Contaminated soil	none
51	UPR-200-W-6	UPR-200-W-6, UN-200-W-6, contamination spread from 241-U-151 and 241-U-152 Diversion Boxes	The contamination spread occurred at the 241-U-151 and -152 Diversion Boxes, located east of the U Tank Farm, near the corner of 16th Street and Camden Avenue.	1950 to ?	Associated with the 241-U-151 and 241-U-152 Diversion Boxes.	The ground around the 241-U-151 and the 241-U-152 Diversion Boxes has been covered with gravel. The diversion boxes are marked and posted. A WIDS sign has been placed at the approximate location of the release.	Unplanned Release	none	not available	Ground contamination from diversion boxes	Maximum dose rate of 20 mrad/h on the surface of the soil.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
52	UPR-200-W-28	UPR-200-W-28, Release from 241-TX-155 Diversion Box, UN-200-W-28	The release site is located adjacent to the 241-TX-155 Diversion Box, approximately 244 m (800 ft) east of the TX Tank Farm and north of the 200 West Area Powerhouse Pond.	1954 to ?	Associated with the 241-TX-155 Diversion Box.	The documented contaminated area was found at the 241-TX-155 Diversion Box. There is a large posted URM area west of the diversion box and several smaller radiologically posted areas in this vicinity (see UPR-200-W-113 and UPR-200-W-135). The diversion box has been isolated and weather covered and is marked and posted with various radiological control signs. A WIDS sign has been placed at the approximate location of the release.	Unplanned Release	UPR-200-W-5, UPR-200-W-113, UPR-200-W-131, UPR-200-W-135	9.1 x 30.5 m (30 x 100 ft)	Contaminated soil	In 1970, soil samples reported less than detectable contamination. Over the years, contaminated vegetation, animal feces, and soil specks periodically have been identified.
53	UPR-200-W-29	UPR-200-W-29, transfer line leak, UN-200-W-29, UPR-200-W-27	The site is located at the southeast corner of the intersection of Camden Street and 23rd Street. The release site is located adjacent to the 241-TX-155 Diversion Box, approximately 244 m (800 ft) east of the TX Tank Farm and north of the 200 West Area Powerhouse pond.	1954 to ?	Associated with the 241-T-152 Diversion Box.	The area is currently surrounded with steel posts, covered with gravel, and posted as a URM area.	Unplanned Release	UPR-200-W-64, UPR-200-W-97	30.5 x 22.9 m (100 x 75 ft)	Less than 3800 L (1000 gal) estimated to have escaped.	Contaminated soil with a maximum dose rate of 11.5 rad/h at a distance of 5 cm (2 in.) over waste run-off area and up to 4.5 rad/h at 0.9 m (3 ft) near the cave-in. February 1998 rad survey detected no surface contamination.
54	UPR-200-W-32	UPR-200-W-32, UNH transfer line break, UN-200-W-32	The release occurred near the northwest corner of REDOX Plant.	The release occurred in 1954	204-S Facility	The release site is not currently marked or posted. The above ground pipeline has been removed.	Unplanned Release	none	not available	An unknown amount of UNH.	none
55	UPR-200-W-35	UPR-200-W-35, Ground Contamination Near UNH Process Line, UN-200-W-35, REDOX to 224-U UNH Line Leak	The site was located along the above ground UNH process line that ran from REDOX to U Plant, at a location just outside and to the north of the REDOX exclusion area.	The release occurred in September 1955	204-S Facility	Much of the area north of REDOX has been surface stabilized. The UPR site is not marked or posted.	Unplanned Release	none	not available	An unknown amount and concentration/activity of UNH solution.	none
56	UPR-200-W-38	UPR-200-W-38, Line Break at 241-TX-302C, UPR-200-W-160, UPR-200-W-40, UN-200-W-38, 216-T-30	The release occurred on the southeast side of T Plant (221-T), between the 241-TX-154 Diversion Box and the 241-TX-302 Catch Tank. The liquid release affected a large area between the 221-T and 222-T buildings. The release site is located adjacent to the 241-TX-155 Diversion Box, approximately 244 m (800 ft) east of the TX Tank Farm and north of the 200 West Area Powerhouse Pond.	1955	Release associated with 241-TX-154 Diversion Box and 241-TX-302C Catch Tank. UPR-200-W-21 occurred in the same vicinity in 1953.	The area around the 241-TX-154 Diversion Box and the catch tank has been stabilized with sprayed concrete (shotcrete). The area is posted with URM area signs. A WIDS sign has been placed at this location.	Unplanned Release	UPR-200-W-21	Approximately 139.35 m^2 (1500 ft^2). Cleanup activities increased the contaminated area to approximately 371.6 m^2 (4000 ft^2).	Contaminated with radioactive metal waste solution that is high salt and neutral to basic. Estimated volume of up to 19,000 L (5026 gal).	In 1968, the maximum dose rate encountered through backfill was 500 mrad/h. Note: it is reported that a hose with 33 rad/h contamination was buried in the backfill over the area.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
57	UPR-200-W-64	UPR-200-W-64, Road Contamination at 23rd and Camden, UN-200-W-64	The release is located between the east shoulder of Camden Avenue and the posted URM area (UPR-200-W-29/UPR-200-W-97), near the corner of 23rd Street and Camden Ave.	1969 to ?	UPR-200-W-29 and UPR-200-W-97 are the apparent source of contamination for this release.	The corner of 23rd and Camden has been stabilized with clean gravel because of two waste line leak events. The stabilized area is surrounded with chain and posted with URM area signs. The road shoulders are not posted. A WIDS sign has been placed at the approximate location of the release.	Unplanned Release	UPR-200-W-29, UPR-200-W-97	Approx. 15.4 x 0.6 m (50 x 2 ft) strip bordering Camden Avenue at its intersection with 23rd Street	Cs-137 was the only detectable radioactive isotope; source appears to be rain water runoff from adjacent UPR areas.	In 1969, contamination up to 600 cpm was reported.
58	UPR-200-W-97	UPR-200-W-97, Transfer Line Leak, UN-216-W-5, UN-200-W-97	The release occurred southeast of the T Tank Farm at the corner of 23rd Street and Camden Avenue.	1966	Associated with the underground pipeline connecting 241-T-152 Diversion Box and the 241-TX-153 Diversion Box. It occurred at the same location as UPR-200-W-29 and adjacent to UPR-200-W-64. The site is associated with UPR-200-W-29, because a repeat release from the same broken transfer line (documented in UPR-200-W-29 in 1954) occurred again in 1966.	The site is located at the corner of 23rd Street and Camden Ave. It is marked and posted as "Underground Radioactive Material". The release site was stabilized with clean soil, sand, ureabore herbicide, and crushed rock.	Unplanned Release	UPR-200-W-29, UPR-200-W-64	36.6 x 1.8 m (120 x 6 ft)	Waste was a high salt, neutral to basic solution; second-cycle bismuth phosphate waste from 241-T-107 Tank; leak estimated to contain about 10 Ci of fission products.	1966 dose rate at bottom of 3 ft hole was 9 rad/h. 1990 rad survey detected subsurface contamination of 600 cpm, down from the 60,000 cpm reported in the 1978 survey.
59	UPR-200-W-98	UPR-200-W-98, UN-216-W-6, 221-T waste line break at R-19, UN-200-W-98	The release site is located near the southeast corner of the 221-T Canyon Building, at door R-19.	1945	Associated with underground pipelines near the R-19 section of the 221-T Canyon Building.	The area around door R-19 is paved with asphalt and posted as a URM area. There is no sign that specifically marks the area as a UPR site.	Unplanned Release	UPR-200-W-2	not available	Approximately 10 Ci of high-salt, neutral-to-basic fission products.	Maximum dose rate of 20 rad/hour (in 1945) at 5 cm (2 in.). 1975 rad survey reported 500 cpm. In 1977, test holes cut to 4 ft in release area detected no rad contamination.
60	UPR-200-W-102	UPR-200-W-102, UN-216-W-12, UN-200-W-102, 224-T Underground Line Leak	The UPR occurred adjacent to the south and east sides of the 224-T Building.	1972	Associated with underground process lines at the 224-T Building.	The east and south sides of the 224-T Building are covered with gravel. The area along the east side of the 224-T Building is posted as a URM area.	Unplanned Release	none	15.24 x 3.66 m (50.0 x 12.0 ft)	The release consisted of alpha-laden moisture from process tank lines that contaminated the soil around the pipeline. An estimated 72 g of plutonium were contained in the contaminated soil that was removed when the leak was discovered.	August 2000 rad survey detected no contamination.
61	UPR-200-W-113	UPR-200-W-113, Soil Contamination East of theTX Tank Farm, UN-216-W-23, Contamination Areas Around 241-TX-155 Diversion Box, UN-200-W-113	The site is an area east of the TX Tank Farm, on the east side of Camden Ave. Posted CAs are located west, south, north, and east of the 241-TX-155 and 241-TX-152 Diversion Boxes.	1977 to ?	Associated with the 241-TX-155 and 241-TX-152 Diversion Boxes and associated underground pipelines going into and out of the diversion boxes.	The original contaminated area was surface stabilized in 1990 and is surrounded with concrete marker posts and posted as a URM area. In 1998, 1999, and 2000, additional surface contamination was identified adjacent to the surface stabilized area and on the north, south, east and west sides of the diversion boxes. CAs also have been identified on the surface of underground transfer lines associated with the 241-TX-155 Diversion Box. The additional CAs, also considered a part of this site (UPR-200-W-113) and are marked with posts, chain, and CA and Soil Contamination Area signs. One small CA, southeast of 241-T (located on a transfer line to the diversion box) recently was stabilized with gravel and now is posted with URM area signs.	Unplanned Release	UPR-200-W-28, UPR-200-W-76, UPR-200-W-135	not available	Multiple UPRs. Contaminated rabbit feces and low-level beta/gamma surface contamination. Source of contamination was subsurface.	August 1998 underground pipe rad survey detected up to 80,000 cpm.; October 1999 rad survey detected 20,000 cpm on rusty railroad rail.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
62	UPR-200-W-114	UPR-200-W-114, UN-216-W-24, Ground Contamination East of SX Tank Farm, UN-200-W-114	UPR-200-W-114 was located east of the SX Tank Farm.	1980	Associated with multiple releases from operation activities in the SX Tank Farm, and the 241-SX-151 and 241-S-151 Diversion Boxes. Documented operational releases extending eastward from the tank farm include UPR-200-W-20, UPR-200-W-49, UPR-200-W-50, UPR-200-W-51, UPR-200-W-52, and UPR-200-W-82.	This site is no longer marked or posted. For many years, the release site had been a large area posted with a light chain and Surface Contamination Area signs. The 216-S-8 Trench and the 216-S-1 and the 216-S-2 Cribs were located within the larger contamination zone. The surface contamination was scraped up and consolidated into other nearby waste sites. The cribs were individually surface stabilized and reposted with URM area signs.	Unplanned Release	UPR-200-W-20, UPR-200-W-49, UPR-200-W-50, UPR-200-W-51, UPR-200-W-52, UPR-200-W-82	106.68 x 137.16 m (350.0 x 450.0 ft); about 4.8 ha (11.9 ac)	Waste consists of particulate matter.	none
63	UPR-200-W-131	UPR-200-W-131, Release from 241-TX-155	The release occurred near the 241-TX-155 Diversion Box, located east of Camden Avenue and east of the TX Tank Farm.	1953	Associated with the 241-TX-155 Diversion Box, the 241-TX-302 Catch Tank.	The 241-TX-155 Diversion Box and 241-TX-302B Catch Tank are surrounded with post and chain and CA signs. Clean gravel has been placed around the diversion box, and a sign has been added to the chain boundary, identifying this to be the location of UPR-200-W-131.	Unplanned Release	UPR-200-W-113	not available	Multiple UPRs of dilute acidic waste solution. Contaminated rabbit feces and low-level beta/gamma surface contamination. Source of contamination was subsurface.	Ground contamination up to 25 rad/h at 0.6 m (2 ft).
64	UPR-200-W-135	UPR-200-W-135, Release from 241-TX-155, UN-200-W-135	The cave-in associated with UPR-200-W-135 was located approximately 46 m (150 ft) northwest of the 241-TX-155 Diversion Box. The diversion box is located east of Camden Avenue and east of the TX Tank Farm.	1954	Associated with the 241-TX-155 Diversion Box.	Three major encased transfer lines are associated with the 241-TX-155 Diversion Box. Many areas of contamination have been identified on these transfer lines during 1999, 2000, and 2001. UPR-200-W-113 is located on a transfer line directly west of the 241-TX-155 Diversion Box and is surrounded with concrete marker posts and URM area signs. An extension of UPR-200-W-113 is located northwest of the original area, surrounded with metal posts and chain, and posted with CA signs. A single metal post, labeled UPR-200-W-135, has been placed adjacent to the UPR-200-W-113 CA.	Unplanned Release	UPR-200-W-13	12.19 x 0.61 m (40 x 2 ft)	Estimated 1000 gal of mixed waste.	Estimated 300 rad/h at a distance of 10 cm (4 in.).
65	UPR-200-W-161	UPR-200-W-161, UN-216-W-35, UN-200-W-161	The site is located east of the U Tank Farm, on the east side of Camden Ave. It extends northward from the corner of 16th Street and Camden Ave. and the 241-U-152 Diversion Box.	1990 to ?	Associated with U Tank Farm. A tank farm pipeline is buried in this approximate location.	The site is a large radiologically controlled area posted with URM area signs. A WIDS number sign has been posted at this location.	Unplanned Release	none	280 x 50 m (918.6 x 164 ft); approx. 0.77 ha (1.9 ac)	Windblown contaminated soil particles.	The general contamination was 250 to 450 cpm; one area up to 8,000 cpm. 1990 soil sample results: 2,930 pCi/g strontium, 6.26 pCi/g Cs-137, 3.27 pCi/g plutonium, and 0.00000026 pCi uranium. 1990 rad survey detected up to 80,000 cpm.
66	UPR-200-W-164	UPR-200-W-164, Overhead UNH Line Leak, UN-216-W-29	UPR-200-W-164 affects the soil beneath the aboveground UNH pipeline that extended from 204-S to 224-U. The pipeline was attached to a steam line located north of 204-S.	The release occurred in 1952	Associated with the above ground UNH transfer line from the 204-S Storage Tanks to the 224-U Building.	The above ground UNH line has been removed. The Radiation Area signs that surrounded the pipeline also were removed. A portion of the site was interim stabilized in 1993. An area of contaminated soil found under the steam line, adjacent to the 216-S-9 Crib, was covered with clean soil and posted with "Underground Radioactive Material" warning signs.	Unplanned Release	none	not available	An unknown amount of UNH.	none

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
67	UPR-200-W-167	UPR-200-W-167, Contamination Migration from the TY Tank Farm, UN-216-W-32	UPR-200-W-167 was located adjacent to the TY Tank Farm fence, extending east and north from the fence.	1985 to ?	Associated with TY Tank Farm operations and WIDS sitecode 200-W-78.	The original release site, identified in 1985, was a Soil Contamination Area located adjacent to the east side of the TY Tank Farm. After the contamination was scraped and removed in 1986, the site was no longer marked or posted. Later, in 2000, three areas on the east and northeast sides of the TY Tank Farm (within the original boundaries of this UPR) were reposted as CAs. Contaminated ant hills and growing contaminated vegetation was found on top of a tank farm transfer line located outside the eastern tank farm fence (also see WIDS sitecode 200-W-78). In November 2000, the CAs were covered with biobarrier material and gravel. These areas were reposted with URM area signs. The underground radioactive pipeline is marked with posts and "Radioactive Pipeline" signs. The pipeline runs through the recently stabilized areas.	Unplanned Release	none	Approximately 192 m (630 ft) long and ranged from 42 m (140 ft) to 60 m (195 ft) wide; approximately 8,400 m^2 (90,000 ft^2) in an "L."	Radioactive contamination (specks) that migrated from TY Tank Farm; later, contaminated vegetation and ant hills found in this area.	1987 and 1988 rad surveys reported no detectable contamination.
68	UPR-600-20	UPR-600-20, UN-216-E-41, Cross Country Transfer Line Contamination, Cross Site Transfer Line, V360, V361	The site extends from the 241-ER-151 Diversion Box in the 200 East Area to the 241-UX-154 Diversion Box in the 200 West Area. The majority of the transfer line is located in the 600 Area between the 200 East and West Areas, south of Route 3. The pipeline is approximately 2.3 miles long.	1988 to ?	Associated with the 241-ER-151 Diversion Box (east end of the pipeline), the 241-EW-151 Vent Station (along middle of pipeline), and the 241-UX-154 Diversion Box (west end of the pipeline).	The underground transfer line extends from the U Plant in the 200 West Area to the 241-ER-151 Diversion Box in the 200 East Area. The site includes the contaminated soil and vegetation located on the surface of the cross site transfer line, as well as the pipeline itself. The surface of the underground line has been stabilized and currently is posted with "Underground Radioactive Materials" signs. There also is a large mound of soil, located south of the 241-EW-151 Vent Station, that is associated with the original transfer line surface stabilization activities. The soil mound is posted with URM area signs.	Unplanned Release	none	4,828 x 15.2 m (15,840 x 50 ft)	Contaminated pipe, any subsurface leaks, and associated surface and vegetation contamination. Contaminated soil contained Cs-137, Pu-239/240, Sr-90, and uranium.	Contamination levels to 750 mrem/h. In 1988, 8 boreholes were drilled at 4 locations along transfer line to characterize integrity. No contamination was found to have leaked below pipeline encasement, but contaminated sagebrush was found next to encasement (indicating that roots penetrated the encasement); June 2000 rad survey detected 30,000 cpm on ant mound.
69	UPR-200-W-82	UPR-200-W-82, contamination spread at 240-S-151	The contamination spread was located on the north and east sides of the 240-S-151 Diversion Box and the 240-S-302 Catch Tank, on the north side of the REDOX facility (202-S).	1980	Associated with the 240-S-151 Diversion Box and the 240-S-302 Catch Tank.		Unplanned Release	none	Approximately 186 m^2 (610 ft^2)	not available	none
70	200-W-58	200-W-58, Z-Plant Diversion Box #1	Z Plant Diversion Box #1 is located south of 234-5Z, in between the two fences that make up the double enclosed Z Plant exclusion area. It is directly south of the 241-Z-361 Settling Tank.	Unknown	Associated with the 241-Z-361 Settling Tank, 216-Z-1, 216-Z-2, 216-Z-3, 216-Z-1A, 216-Z-12, and 216-Z-18.	The Z-Plant fenced exclusion area is covered with gravel. The concrete lid of the diversion box is visible above ground. The unit is buried to a depth of 2.7 m (9 ft), and its upper surface (a thick concrete lid) is slightly above ground level.	Valve Pit	none	not available	not available	none

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
71	200-W-59	200-W-59, Z-Plant Diversion Box #2	Z Plant Diversion Box #2 is located southwest of the 234-5Z Building, between the two fences that make up the double enclosed Z Plant exclusion area. It is west of the 241-Z-361 Settling Tank and directly north of the 216-Z-12 Crib.	N/A	Associated with 216-Z-361, 216-Z-12, and 200-W-58.	The structure is buried with its concrete lid slightly above ground level. The Z Plant fenced exclusion area is covered with gravel.	Valve Pit	none	not available	not available	1976: 5000 dpm at 17 ft bgs found when drilled 2 wells near the crib pipelines and Diversion Box.
72	HSVP	HSVP, Hot Semiworks Valve Pit, 201-C Diversion Box, Semiworks Valve Pit	This valve pit is adjacent to the remains of the 201-C Building and southeast of the main canyon area. It is located within the 200-E-41 surface stabilized area.	1951 – 1986 or 1952 to 1963	Associated structures include the 201-C Building, valves, transfer lines, the 244-CR Vault, C Tank Farm, and the 241-CX-70 Tank. Also associated with 200-E-41 Stabilized Area.	The site is a sealed, concrete-filled, vertically configured, stainless-steel cylinder that is buried beneath the ash barrier that was placed over the decommissioned 201-C Process Building (see 200-E-41). The surface-stabilized area is posted with URM area signs. The valve pit is not separately marked or posted.	Valve Pit	none	not available	Diversion box may contain about 23 kg (50 lb) of lead shielding.	none
73	200-E-56	200-E-56, 241-C Waste Line Leak adjacent to 201-C, Waste Line Leak #1	The waste line leak was adjacent to the east side of the 201-C Building.	not specified	The site is associated with 200-E-41.	HW-52860 states that Teflon flange gaskets on the stainless steel underground waste line from 201-C to the C Tank Farm developed leaks. The leaks caused the underground area next to the east side of the 201-C Building and an underground area near the east facility fence to become contaminated (see 200-E-57). Radiation readings in 1957 were greater than 100 rad/h at a depth of 3.66 m (12 ft) adjacent to the 201-C Building and near the fence. The underground waste line was abandoned, and bypass sections were installed. New sections of pipeline were installed south of the leaking sections. The area adjacent to the 201-C Building has been surface stabilized with fly ash. The stabilized area has been given the site code 200-E-41 and is posted as a URM. The release site is not separately marked or posted and may be combined with 200-E-41. When the facility was operating, the area was enclosed in a fence. A second fence, attached to the 201-C Building, formed areas known as the "A" Court Yard and "C" Court Yard.	Unplanned Release	200-E-57	not available	not available	Maximum contamination levels in 1957 were greater than 100 rad/h at a depth of 3.66 m (12 ft). Some contaminated soil was removed when the bypass pipelines were installed.
74	200-E-57	200-E-57, 241-C Waste Line Leak east of 201-C, Waste Line Leak #2	This release occurred at an underground waste line located east of the 201-C Building, adjacent to the east Hot Semiworks fence. The fence no longer exists.	not specified	The site is associated with 200-E-41.	HW-52860 states that Teflon flanges on the 5 cm (2-in.) stainless steel underground waste line from 201-C to the C Tank Farm leaked and caused the soil beneath the line to become contaminated. One leaking flange was located near the Hot Semiworks fence. The sketch attached to HW-52860 indicates an underground contaminated area measuring 9 m (30 ft) long. Radiological readings in 1957 ranged from 6 rad/h at a depth of 0.3 m (1 ft) to greater than 100 rad/h at a depth of 4.5 m (15 ft) at this location. The document states that the line also leaked in an area adjacent to the east side of the 201-C Building (see 200-E-56). The underground waste line was abandoned, and bypass sections were installed. New sections of pipeline were installed south of the leaking sections. The area around the Hot Semiworks Plant has been surface stabilized with fly ash. The stabilized area is known as 200-E-41 and is posted with URM signs. This release site is not separately marked or posted and may be combined with 200-E-41. When the facility was operating, the area was enclosed in a fence. A second fence, attached to the 210-C Building, formed areas known as "A" Court Yard and "C" Court Yard.	Unplanned Release	200-E-56	area 9 m (30 ft) long	not available	Maximum contamination levels in 1957 were greater than 100 rad/h at a depth of 4.5 m (15 ft). Some contaminated soil was removed when the bypass pipelines were installed.

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
75	200-E-135	200-E-135, Contamination Area South of C Tank Farm	The site is located south of 7th Street and southwest of the C Tank Farm.	not specified	one direct-buried 12-in cooling water pipeline is known to be in area; other sources are likely	An abandoned, aboveground steam pipe is located inside the posted area. The DynCorp ISVAC group submitted this CA as a Discovery Site because of growing contaminated vegetation. Growing contaminated vegetation usually suggests the presence of an underground pipeline. The drawings reviewed found one 30 cm (12-in.) diameter "Direct Buried" cooling water line near where one of the tumbleweeds was found. The line passes through the eastern end of the posted CA. It may be a contributing source of contamination. However, the large size of the posted area indicates that other sources (currently unknown) are likely. In September 2000, three growing, contaminated tumbleweeds were found inside the posted area. The maximum contamination level was 1000 c/min above background. All of the contaminated weeds were detached from the ground and removed by the DynCorp ISVAC group in September 2000. An assessment survey was performed in April 2002 and found maximum direct readings of 5,000 and 100,000 c/min inside the posted area. In July 2002, the area was surface stabilized and downposted to a URM.	Unplanned Release	none	102.4 x 50 m (336 x 164 ft); irregular	not available	April 2002: maximum direct readings up to 100,000 cpm.
76	200-W-9	200-W-9, Project W291 Excavation VCP Contamination	The site is located in the 200 West Area, near the southeast corner of the 221-T Building. It is 42 m (138 ft) north of 23rd Street.	1994	The 25 cm (10-in.) VCP carried chemical sewer effluent from 291-T, 222-T, and 224-T to the 216-T-3 Crib.	An old VCP was uncovered while excavating for the T Plant manhole MH T-2 for the new waste line from T Plant to the 200 Areas Treated Effluent Disposal Facility (Project W-291). The pipeline was left in the excavation. The site currently is a gravel area with two metal caissons. The area is not marked or posted. The tops of the caissons are labeled MH T-1 and MH T-2. The contamination was found on October 11, 1994. The old VCP is assumed to be a 222-T chemical sewer.	Unplanned Release	none	1.83 x 1.52 m (6 x 5 ft)	not available	1994 rad survey reported 3000 dpm beta/gamma on 100 cm^2 (15.5 in^2) smear, 5500 dpm direct reading.
77	200-W-15	200-W-15, S-Plant Project W-087 Hexone Discovery	The site is located ~18 m (59 ft) southwest of the southwest corner of REDOX (202-S).	not specified	202-S REDOX, 222-S, and the 244-S Double-Contained Receiver Tank are associated with the site	In June 1995, while excavating pipe trench for Project W-087 (new transfer lines from 222-S to the 244-S Double-Contained Receiver Tank), a dark 4.6 cm (3-in.) thick layer of soil was noted at about 0.6 m (2 ft) depth. It was determined to be hexone and surfactants. The hexone soil was stockpiled and returned to the excavation after the pipe was installed in the trench. The pipe trench where the hexone soil was found has been backfilled to grade with soil originally removed from the excavation. Hexone-contaminated soil also was put back into the excavation. Currently there is no visual evidence of this excavation on the surface. The area is now under asphalt. It is not marked or posted. Hexone was used in the adjacent facility (202-S REDOX).	Unplanned Release	none	12.19 x 2.44 m (40 x 8 ft)	not available	none
78	UPR-200-E-79	UPR-200-E-79, UN-216-E-7, 242-B to 207-B Line Break, UN-200-E-79	The area where the release occurred is delineated by light-duty posts and chain measuring approximately 7.6 m (25 ft) wide and 61 m (200 ft) long. It is posted with URM area signs.	1953	The site is associated with the 207-B Building; leaking waste line (4-in. cast iron) that runs from 242-B to 207-B	In June 1953, five leaks were discovered in the waste line that runs from 242-B to 207-B. Contamination levels up to 2,500 c/min were measured at the points of emission of water from the ground. The area where the release occurred is delineated.	Unplanned Release	none	61 x 7.6 m (200 x 25 ft)	Release consisted of 10 Ci of mixed fission products from the pipeline.	none

Table A-2. Waste Information Data System 200-IS-1 Operable Unit Summary Information. (15 Pages)

Count	Site Code	Site Names	Location	Dates of Operation	Associated Facilities or Structures	General Description	Site Type	Associated UPR Waste Site(s)	Site Dimensions/ Area	Contaminant Inventory/Volume Released	Radiation Survey/ Soil Sampling Information
79	UPR-200-W-14	UPR-200-W-14, Waste Line Leak at 242-T Evaporator, UN-200-W-14	The 1952 release occurred in an underground pipeline, causing water to be observed on the surface, east of the TY Tank Farm. The exact location was not documented. The mapping coordinates have been estimated.	1952	The release is associated with the 242-T Evaporator, 207-T Basin, and 200-W-78.	In October 1952, a steam coil in the 242-T Waste Evaporator Tank caused ground contamination along the surface above the leaking cast-iron pipe that carries cooling water and steam condensate from the waste evaporator building to the 207-T Retention Basin. The site is described as the surface above the waste line between the 242-T Evaporator and the 207-T Retention Basin. H-2-44511 shows a cast-iron pipeline connecting the evaporator with the retention basin. The pipeline carried steam condensate from the building to the basin. The line runs north to south along the east side of the TY Tank Farm, parallel to an encased waste transfer line. The release site is not specifically marked or posted. However, several areas of contamination were identified along the east side and northeast of the TX/TY Tank Farms in 2000 and 2001 by the DynCorp ISVAC group (site code 200-W-78). The areas were stabilized with clean dirt and posted as a URM area. Because the exact location of this 1952 UPR is not documented, it is possible that one of the areas stabilized in 2001 is in the same location as the 1952 line leak. The mapping coordinates for the 1952 line leak have been estimated from the limited information provided. HW-60807, written in 1959, states that the area was posted at intervals with Underground Contamination signs. The document provided a hand-drawn sketch of the 200 West Area with a dot indicating UPR locations. This release is indicated on the sketch as being located east of the TY Tank Farm, but it cannot be precisely located from this sketch. The coordinates for this UPR have been estimated. In 1999, 2000, and 2001, the DynCorp ISVAC group attempted to mark all underground lines in the 200 East and 200 West Area. During their activities, many areas of contamination were identified above the underground lines being marked. The CAs were posted and later stabilized and changed to URMs. It is possible that one of these areas is in the same location as this 1952 release. The leak in the line was repaired in 1952, and the contaminated areas were covered with about a foot of clean soil and gravel.	Unplanned Release	none	not available	not available	none
80	UPR-200-W-99	UPR-200-W-99, UN-216-W-7, 241-153-TX Diversion Box Contamination Spread, UN-200-W-99	The release site is located east of the TX Tank Farm, extending approximately 69 to 91 m (75 to 100 yards) east of Camden Avenue.	1966	Associated with the 241-TX-153 Diversion Box and Camden Avenue	UPR-200-W-99 occurred on September 21, 1966. Two plumes of airborne contamination from the 241-TX-153 Diversion Box floated northeast and southeast. The releases contaminated the ground and road on both sides of Camden Avenue. The total length of contamination was identified to be 228 m (750 ft) north and south along Camden Avenue. The contamination extended a maximum of 91 m (300 ft) east of Camden Avenue. The maximum contamination found was 700 mrem/h. The area on the east of Camden Avenue, east of the TX Tank Farm, was stabilized with soil and grass. It is marked with URM signs. In 1966, the road contamination was covered with a new tar mat, and the sides of the road were fixed with tar. The area on the west side of Camden Avenue, adjacent to the tank farm fence, was covered with gravel, but was recontaminated by windblown particulates from the TX Tank Farm in 1993. In 2001, this area was no longer marked or posted. In 1976, a road grader was used on the soil east of Camden Avenue to push the contamination into windrows. Test plots in this area revealed a thin layer of Sr-90 particles present. The area east of Camden Avenue was surface stabilized in 1990 with clean backfill and grass. This area is surrounded with URM signs and is maintained by Bechtel Hanford, Inc.	Unplanned Release	none	228.6 x 91.44 m (750 x 300 ft); stabilized area measures approximately 228 x 44 m.	Airborne particles containing approximately 1 Ci Sr-90, with maximum readings up to 700 mrad/h.	none

Teflon is a trademark of E.I. du Pont de Nemours and Company, Wilmington, Delaware.
H-2-44511 Series, *Area Map – 200 West Area Facilities*.
HW-52860, *Standby Status Report Hot Semiworks Facility*.
HW-60807, *Unconfined Underground Radioactive Waste and Contamination in the 200 Areas - 1959*.

CA = Contamination Area.
cpm = counts per minute.
dpm = disintegrations per minute.
DynCorp = DynCorp Tri-Cities Services, Inc.
HSVP = Hot Semiworks Valve Pit.
IMUST = Inactive Miscellaneous Underground Storage Tank.
ISVAC = Integrated Soil, Vegetation, and Animal Control.
MH = manhole.
N/A = not applicable.
PUREX = Plutonium-Uranium Extraction Plant.
REDOX = Reduction-Oxidation Plant.
UNH = uranyl nitrate hexahydrate.
UPR = unplanned release.
URM = Underground Radioactive Material (area).
VCP = vitrified clay pipeline.
WIDS = *Waste Information Data System* database.

DISTRIBUTION

Onsite

1	U.S. Department of Energy Richland Operations Office	
	DOE Public Reading Room	H2-53
1	Pacific Northwest National Laboratory	
	Hanford Technical Library	P8-55
1	Lockheed Martin Information Technology	
	Document Clearance	H6-08

This page intentionally left blank.